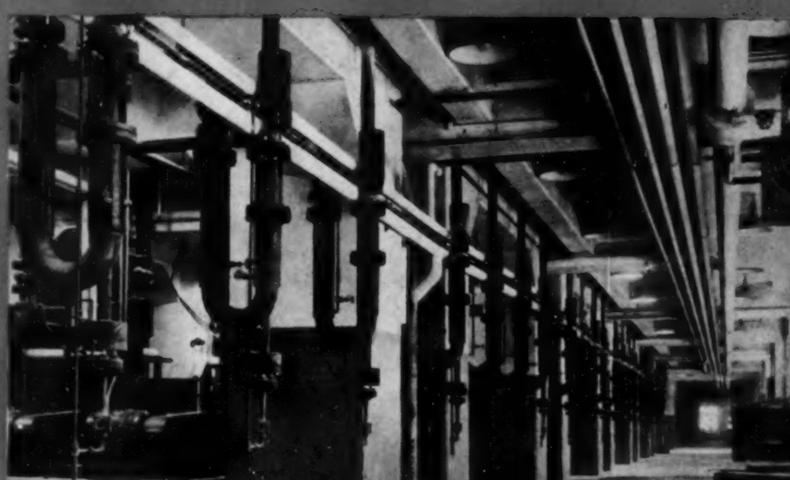
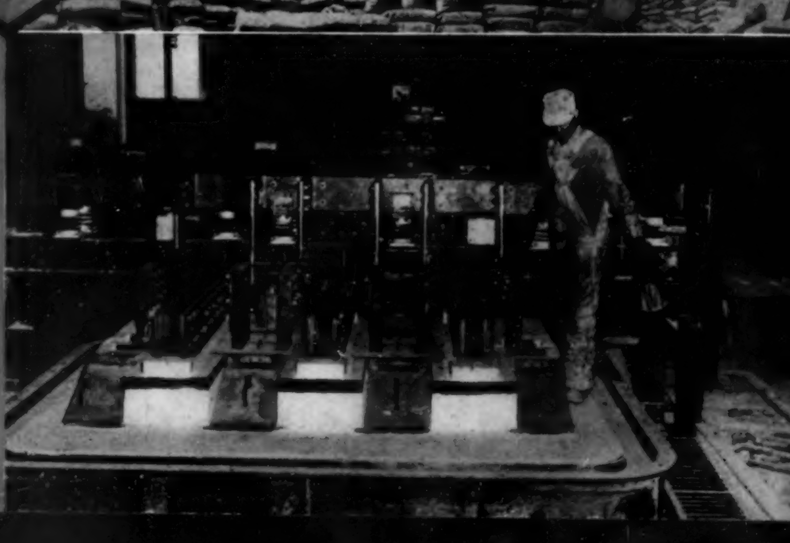
OCT 2

CHEMICAL & METALLURGICAL ENGINEERING





Chem & Met

OCTOBER, 1943

VACUUM FILLS A VOID

Extreme high vacuum is beginning to make its appearance in heretofore impossible distillations and other chemical engineering operations. Largest present use is in the ferrosilicon process for magnesium as in this diffusion pump picture from Ford's plant. See pp. 102 to 105 in this issue.

PAPER RULES WHERE METAL ONCE WAS KING

Wartime demands for previously undreamed of packaging specifications have brought forth developments, especially in paper, that are certain to be converted into peacetime uses. See this month's Chem. & Met. report appearing on pp. 117 to 124.

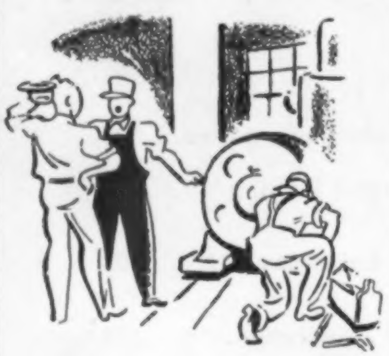
THE WORLD'S LARGEST AND STILL GROWING

Basic Magnesium is the subject of more gossip, has cost more money, and actually turns out more metal than any other magnesium plant in the world. See pp. 98 to 101, for Mr. Ramsey's colorful description of the Southern Nevada giant.

Washington News pp. 139-140

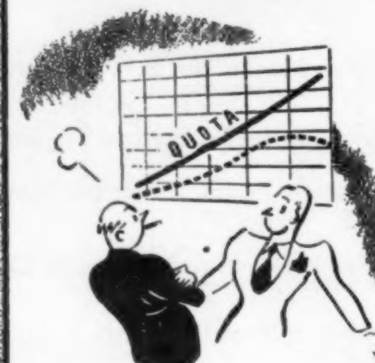
Help Wanted?

. . . to Help Lick
UNEXPECTED BREAKDOWNS?



How many of your key machines were built for 24-hour-day service?

. . . to Help Lick
LOW-GRADE DEPOSITS?



Has increased wartime demand brought new processing problems?

. . . to Help Lick
LAGGING SCHEDULES?

Maybe you have a bottle-neck—an added machine would load up all units.

WHATEVER HELP YOU WANT — CALL ON ALLIS

FRANKLY, MR. PROCESSOR, we don't claim to know everything about your business. But the fact is that our Cooperative Engineering Service is helping hard-pressed processors like yourself straighten out a lot of tough kinks.

There's a reason for this: Because Allis-Chalmers builds *all types* of basic processing equipment... our engineers are *complete line* engineers—trained to look at your problem from the standpoint of *every* machine in your production cycle.

It's their job to know ways to help you make *existing* equipment work together more efficiently ... give you better "machine teamwork."

And if you need equipment, A-C engineers don't

Only Allis-Chalmers Makes a Complete Line of this Equipment!

CRUSHING	SCREENING	GRINDING	PULVERIZING
Jaw, gyratory, roll & hammer crushers — for ore & rock.	Vibrating & rotary screens, wet & dry — largest line in U. S.	Cylindrical mills, ball or rod media, batch or continuous type.	Ball, rod & hammer mills for coarse to micron size product.

Free Enterprise

WE MUST ACT TO PRESERVE IT!

LIKE a leaf floating downstream, we are being carried along toward a new and uncharted economy. What this new economy will be like will depend, to no small extent, upon what industry does or fails to do during the coming months. Time is short; in fact, we may suddenly find ourselves standing on the threshold of a peace economy with our war boots still on our feet.

While bending every effort to win the war, we cannot afford to be caught unprepared for the peace. As Prime Minister Churchill said at Harvard, we are "bound, so far as life and strength allow and without prejudice to our dominating military task, to look ahead to those days which will surely come, when we shall have finally beaten down Satan under our feet and find ourselves with other great Allies at once the masters and the servants of the future." Unless we do look ahead, there is danger that we may become neither the masters nor the servants, but merely the victims, of the future.

The war has quickened our ailing economy and opened our eyes again to the possibilities of peace-time plenty. But it has also brought great dislocations of labor and capital; it has led to abnormal patterns in prices and income distribution; and it has created inflationary pressures with enormous potential powers to injure or to help us in the transition from war to peace.

The pattern of life in postwar America will be just what we make it. All of us will have a hand in shaping that pattern, but business men will have a special responsibility in the reconstruction. As employers of labor and capital and as enterprisers assuming the risks of new ventures, they will have to plan and carry out the conversion from war work to full peace-time production. Because of their key role, business men have a special opportunity to discover, and to help others to understand, the conditions which are necessary if they are to do their job satisfactorily.

This is a narrow view of postwar problems but it is a central view, because no one condition is more vital to the health of the world than a high level of production and employment in the United States. We cannot hope to lead the world out of economic chaos if we fail to put our own house in order. If we fail to adjust our domestic economy, we may destroy Adolf Hitler; but we will not destroy the germ that breeds "Hitlers." If we do not maintain the production necessary for supporting a large volume of imports and exports, then the plans for international monetary stabilization, for good relations with our neighbors, for rehabilitation of stricken countries, and for strengthening the democratic bulwarks against dictatorship are all likely to come to grief. We must demonstrate our capacity for world leadership, or be content to follow the leadership of others.

The prospects for achieving a sound and vigorous economy in the United States are not so good as to warrant complacency on the part of men genuinely interested in free enterprise and the political freedoms incident to it. We have yet to find means to utilize our vast and abundant resources for the good of all. We have yet to learn how to keep men from the terrible experience of unemployment and the fear of want which makes them willing to sacrifice freedom and opportunity for almost any promise of security. We have yet to reconcile the conflicting interests of labor, agriculture, and business so that they can work together effectively. We have yet to learn how to check the fever of inflation and cure the palsy of depression.

When we were attacked at Pearl Harbor, we realized our physical peril immediately and united in a tremendous common effort against the enemy. The onset of economic perils is less obvious. No bombs will signal the deterioration of the private enterprise system, the extension of regimentation, the further control of busi-

ness by government, and the concentration of political power in less and less responsible hands. If these things should befall us, they will come insidiously while we are preoccupied with self interests and oriented by popular misconceptions. If the freedoms of the individual shrivel as the state grows in power, it will be because the individual is too indifferent or complacent to concern himself seriously with economic problems. If our people are misled by false prophets and demagogues, it will be because business men did not understand economics, because scholars were too ignorant of practical affairs, and because we failed to produce economic statesmen of sufficient stature for the task in hand.

Thinking is hard work. Thinking about things outside our personal experience, about economic processes that are broader and in some fundamental respects different from buying and selling or running a business – is strenuous mental labor. Thinking straight about problems that are beyond our personal and immediate status and our pocketbooks, thinking about problems that involve nation-wide production, nation-wide employment and nation-wide buying power – in other words the operation of our entire economic system – involves real self-discipline. Yet there is no other way to safeguard our freedoms. We cannot rely on trial and error; tinkering takes too long; social experiments which turn out wrong can be undone only at great cost – if at all. If we proceed blindly, we shall flounder into an economic and political morass from which we cannot escape.

We floundered badly all through the Thirties, until the war lifted us temporarily to higher ground. When the war boom is over, we shall be back floundering worse than ever unless we find a solid road along which to proceed.

America has grown rich and strong under a system of political and economic freedom. Opportunity and the necessity of self-reliance have brought forth great accomplishments. The hope of profit and the spur of competition have urged men on to find new and better products, new and better methods, and to risk their savings in pioneer investment. Never has a country achieved so high a standard of living and afforded so large an opportunity for the individual man and woman. It is not surprising that some distinguished business leaders, looking back over their own experience, tell us that everything will be all right if only there is "less government in business."

I wish the solution were as simple as that. However this is only part of the answer. It is becoming increasingly clear that industrial capitalism as we know it contains within itself certain fundamental weaknesses which can lead to its destruction if they are not counteracted. No democracy can survive when twenty to thirty per cent of its workers cannot get jobs. That happened here in the Thirties. For years on end, despite fumbling efforts at recovery one out of every five workers was denied a chance to earn a living in private business. We shall never again have such mass unemployment as occurred in the bottom of the Depression, because the government will take it upon itself to create jobs if business cannot offer them. Whenever that happens, however, the area of private enterprise will be reduced and that of government will be expanded – and the concentration of political power will be increased. This is the challenge we business men face today, and ours is the first opportunity at finding the solution.

The crux of our economic problem is unemployment. Unless there are jobs for ninety to ninety-five per cent of those who are able and willing to work, there will be widespread fear and lack of opportunity, which will drive labor unions, agricultural groups, and business interests to take self-protective measures. Such measures are certain to restrict production, stifle progress, and imperil our democratic way of life. Not all our problems will automatically be solved if we learn how to avoid mass unemployment, but they will at least then have a good chance of solution.

And so American businessmen face a great responsibility! We will have to find the answer to a great many momentous questions. We will have to delve into problems that cannot be solved by precedent.

Looking backward to these times, future historians are likely to say that here we Americans stood at the crossroads and, consciously or not, made our choice between a system of private enterprise and personal freedom and a system of collectivism and regimentation.

It is particularly appropriate, therefore, as the problems of our time take shape and as events rearrange their order and importance, to appraise the steps we are taking and point the way we are going. It is my plan to present such analyses from time to time to the one-and-a-half million readers of McGraw-Hill publications.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

CHEMICAL
& METALLURGICAL
ENGINEERING

ESTABLISHED 1902

S. D. KIRKPATRICK, *Editor*

OCTOBER, 1943

OUR WAR LESSON NO. 2

On this page last August we proffered the opinion that as a country we will have failed to learn from this war's experience if we abandon completely the research and development work that has made us masters of military science and technology. From the reactions received from high officials in the government and in the armed forces, as well as from engineering educators and engineers in industry, we have reason to believe that we are not going to make the same mistakes we did after World War I.

Second only to our progress in applying science to war production is the use our industries have made of economic and statistical information bearing on supply and demand, inventories, prices and distribution trends. In the War Production Board's commodity divisions, in the Office of Rubber Director, in the Petroleum Administration for War, and elsewhere, have been set up statistical controls that are far more comprehensive and efficient than any of their peacetime predecessors.

Under strong pressure of wartime needs, figures are collected promptly, analyzed, interpreted and put to proper use. The newer agencies seem to have avoided or overcome most of the older inhibitions that so often delayed and detracted from the value of census data. But all governmental departments, including the Census Bureau, have cooperated wholeheartedly in the program of speeding up the statistical processes to make results most useful in the war effort.

What's to become of all this fine work after the war is won? Are we going to close the books and burn the files when the wartime agencies are abandoned? Or, are we going to take stock of what we have accomplished and set up permanent machinery for carrying on the work that is of most value to industry and to the general public? Unless we give some thought to these questions now, the answers may go by default during the hectic days of demobilization.

Looking back to World War I, we in the chemical industry can appreciate some of the benefits that have resulted from the few statistical series that got their start in war work. First in importance is undoubtedly the census of dyes and organic chemicals, inaugurated by the United States Tariff Commission in 1917 as a means of checking the progress of production for essential materials that had previously been imported. It would indeed be difficult to put a value on the part played by the "dye census" in building our synthetic organic chemical industry.

From the chemical section of the old War Industries Board came the practice of setting up distribution surveys to show the percentage of production used in the various consuming industries. Lacking official machinery for continuing these surveys, *Chem. & Met.* has carried them on for a few commodities such as sulphuric acid, caustic soda and soda ash. We are the first to admit, however, that much greater value would have accrued from a broader program sponsored by a governmental agency or a trade association.

Under the leadership of Dean Edwin F. Gay, of the Harvard Business School, the War Industries Board published during 1919 and 1920 an exhaustive series of bulletins on the wartime history of prices for practically all important groups of commodities. Many of these set up price index numbers which have since been continued by other governmental and private agencies. Unfortunately, however, most of the machinery was dumped back into the Bureau of Labor Statistics where price studies are made by other than commodity experts. Those who have had experience with some of the Bureau's indices can appreciate what that has meant in the way of inadequacy and occasional but unintentional inaccuracy.

Many other examples of wartime advances and peacetime retreats in the collection and use of statistics could be cited from the experiences of the Bureau of Mines, the Geological Survey, and the Commerce Department. Yet these are perhaps sufficient to remind us that Washington now has a wealth of facts and figures that could be of almost inestimable value

were they translated into continuing statistical services to American industry. Nor should we forget that from the public interest it is short sighted and perhaps unfair to let these figures become the exclusive property of those who have worked so hard and patriotically in their compilation. No matter what is done, these men and women will return to private employment with much better knowledge of the industries they have been studying. No one will deny them that compensation for their war work. But if we are wise and have learned well our war lesson No. 2, we will insist on prompter, more comprehensive and more intelligent statistical services as a result of industry's wartime experiences.

$3,000,000,000 WORTH OF CHEMICALS

An amazing record of increasing output has been made by the chemical industry since 1941. President Roosevelt recognized this in his September report to Congress when he said: "Since the outbreak of the war in Europe, we have increased our output of petroleum by 66 percent. We have stepped up our bituminous coal production by 40 percent; chemicals by 300 percent; iron ore by 125 percent; hydroelectric power by 79 percent, and steel by 106 percent."

Few realize the stupendous effort which has been made so successfully in chemical industry. They fail to realize the magnitude and the success because chemicals have never failed to be ready when needed. This is a subject for self-congratulation and a determination to maintain the record unspoiled by any future failure.

TOMORROW'S INDUSTRIES

In our February number we published a list of about fifty so-called "infant industries" which may be expected to experience rapid growth in the postwar period. The list has been widely reprinted and has also been the subject of considerable discussion and controversy. Of course everyone would like to have us pick the winners. As a matter of fact, we were on the verge of conducting a poll among *Chem. & Met.* readers when we discovered that our friendly contemporary, *The Research Viewpoint* (which is published periodically by Gustavus J. Esselen, Inc.), had stolen a march on us. With one of its recent issues it inclosed a ballot and asked its readers to name "the six budding industries which will, in the next decade, contribute most to the progress, employment and general welfare of America."

Top rank among the 39 industries listed in the returned ballots were the following ten, which are listed with their percentages of the total vote: Aviation, 90; radio and electronics, 90; plastics, 87; housing, 50; alloys and metallurgy, 43; food processing, 43; synthetic rubber, 36; chemical engineering, 36; synthetic drugs, 30; and automotive, 28. As the editor wisely noted, chemical engineering is not an industry, but a profession. Significantly, it is one that to some degree serves all of the others, but particularly the six industries in the list that are predominantly chemical. He also noted that all, with the possible exception of housing, are industries that have long depended upon research for their continued development.

This great dependence on the laboratory and the pilot plant was also confirmed not long ago when the editors of *Printers' Ink* asked several thousand business men this question "Which of the following wartime developments do you think will produce the greatest change in conditions under which your business will operate during the postwar period?" They were offered seven factors from which to select the most important. Here's the way the vote turned out in percentage of the total: New products, 18; new materials, 17; new manufacturing processes, 17; aftermath of wartime controls, 16; new competition, 13; shifts in purchasing power, 11; and shifts in population, 6.

Again it is apparent that the postwar period puts its primary challenge up to those who are responsible for new and improved products and processes. Research is the source of improvement and improvements make the jobs that are needed to carry us on to higher standards of good living in the postwar world.

FEWER AND BETTER PACKAGES

When the time comes to consolidate our war gains and to capitalize the lessons we have learned and are still learning, there are three "S" folders in the call-up file. They deal with Substitution, Standardization and Simplification. In each of these there is a subdivision marked "Packages and Packaging Materials." Here, indeed, are records of progress that should be carefully studied by chemical companies in connection with postwar operations.

What has been accomplished with the use of paper products is truly remarkable. Developed as substitutes for metal, fiber or wood containers, many are proving far superior to the older materials in the wartime services they are rendering. The same severe tests have, however, eliminated other substitutes which need no longer demand serious consideration. These are lessons that industry should now be studying.

It is not too soon to revive and revise our thinking about the standardization of packaging and package sizes. Here the National Bureau of Standards is in an enviable position to help and is desirous of promoting sound policies through the cooperation of government and industry. Its recent Letter Circular LC726, "Some Notes on Standardization" suggests practical ways in which simplification has been or can be developed.

Many industrial executives probably do not realize the real commercial advantage that has been achieved by some few groups through common action on packaging policies. A limited number of sizes of packages has been selected by industry itself. A logical relation of package size to customer need largely guides the selection. But the practical working conditions of the factory are also taken into account. The result is a workable group of distinctive sizes that serve consumers' needs without burden on industry. In fact, industries have found a great over-all merchandising saving through the application of such plans.

Even industrial groups for which packaging prac-

tice is not a vital part of merchandising policy can often profit from a simplified package program. It takes time to organize such programs, and still longer effectively and simply to put them into effect. It will be worthwhile, therefore, to look over the situation in each industry and see where improvements of this sort can best be developed. Trade association groups are perhaps the most effective agencies for action. But an individual executive or a single company can often initiate such a movement for the benefit of his own establishment, and for the good of his industry, too.

HOW HIGH THE STOCK PILES?

ABUNDANT supplies of most strategic minerals are now available. There remain virtually no shortages of imported or "critical" raw materials of this type. At present Washington is more concerned about what to do with surplus stockpiles of some of these minerals than it is about the meeting of any reasonable needs of the foreseeable future.

These facts are of importance to a number of divisions of the process industries that use these strategic minerals. No longer do they as processors need to worry about raw material supplies for next month or next year. It is a matter of much greater concern that the future prices of these raw materials should not be unduly high.

The government is continuing the accumulation of certain of these strategic materials under a bonus system. This is a dangerous practice when one can foresee that renewed import of much cheaper raw material may be resumed in the not distant future. One wonders, for example, whether chemical engineers will have to pay excessively for alloy steel for years to come merely because the government is continuing to subsidize the mining of submarginal deposits of certain minerals in the United States.

Many of the divisions of the chemical industry which process scarce minerals can well study these basic questions and make clear to official Washington the long term meaning of present events. No one wishes to take a chance on renewed scarcity. But it is also important that we avoid excessive high-cost stockpiles that will later prove a needless burden during postwar readjustment.

WASHINGTON HIGHLIGHTS

NATIONAL ROSTER review of professional deferment cases is being handicapped by a new WMC policy. Under the changed plan of action these cases must be handled through the United States Employment Service. It now becomes necessary that each employer of chemists and engineers should educate as far as possible the local executives of USES. The leaders of that important service have so few cases involving professional men that without the guidance of industrial executives they may make serious errors in their recommendations regarding deferments.

DECENTRALIZATION of WPB is being planned. Chairman Donald Nelson will be delighted to have suggestions regarding the transfer out of Washington of such units as can better serve the industry from one of the many field offices. No upheaval is planned, fortunately; but steady progress is to be made as opportunity develops for putting this government agency as near as possible to the industries with which it works.

WHISKEY manufacture will not be resumed if plans of WPB and War Food Administration continue as noted during early October. Food officials object to using grain for alcoholic beverages of this sort when there is a serious prospective shortage of foodstuffs. WPB does not dare to allow whiskey capacity to be used except for industrial alcohol. It realizes that the demand for alcohol with which to make synthetic rubber next year will be much greater than most estimates have indicated hitherto. Thus it is not surprising that the hard-liquor industry is forced to remain in the chemical business.

POOLED HAULAGE by private motor carriers often requires payments from one carrier group to another in order to adjust the differences in cost of the delivery business done for the pool. It is now ruled officially that such payments are not subject to the Federal transportation tax of 3 percent. That tax is collected by Uncle Sam on the individual shipments. It is fortunate for shippers of chemicals that a double tax burden does not develop through a second charge when such intercompany settlements are made.

COMMON CITIZENSHIP with the citizens of the British Empire was proposed by Winston Churchill at Harvard University with no casual purpose, despite the off-hand nature of his reference. Most Americans will welcome continued close cooperation with the other English speaking peoples of the world. We will know much more about them and be able to work with them much more closely in the future than in the past. But Americans will want to know whether or not common citizenship, which we might welcome, will necessarily mean a completely free-trade status for goods. That might do much to pull down the standard of living in the United States without corresponding good abroad. American chemical enterprise has much at stake in these matters. It will have to do a lot of serious thinking and planning in order that American well-being can be protected without promoting a narrow, selfish industrial policy at home.

WOMEN'S WAGES should equal those for men rendering the same services. That at least, is now the avowed policy for which C.I.O. intends to fight in the postwar period. President Philip Murray has announced the intention of his organization to press further with this philosophy for wider employment of women in jobs formerly held exclusively by men. The process industries probably will not have as many women working for them in peace times as now, but, looking ahead, we must anticipate such problems and be prepared to solve them.

MOLASSES is again to be supplied for alcohol manufacture on the Eastern Seaboard. This is necessary to save grain for food. It represents one of the advantages of greater control over the sea and greater available tonnage space in tankers. Fortunately, this molasses movement will not interfere with sugar production in Cuba and Puerto Rico; nor will it be allowed to interfere with the development of chemicals from surplus molasses there.

ANNOUNCING THE 1943 AWARD

TO THE AMERICAN

FIVE DAYS after the fifth biennial Award for Chemical Engineering Achievement was officially presented on December 2, 1941, America was plunged into this great global war. Since then her every resource has been dedicated to the primary task of defeating the enemy forces that challenged her future as a nation of free men. Because of wartime restrictions, the story of all that has been accomplished by American industry during the past two trying years cannot yet be told, but there is one vital contribution which is fast approaching completion and for which a grateful country has not been slow to express its appreciation. I refer to the building of a great synthetic rubber industry—America's answer to enemy control of the chief natural sources of a material so essential to the winning of the war and the preservation of our national economy.

The synthetic rubber program has been aptly called "the biggest job of chemical engineering in the history of the world." To have crowded it into the extraordinarily tight situation of the past 24 months with respect to construction materials, manpower and transportation called for a virtual miracle on the part of the industry and profession. It has been possible only because of the patriotic pooling of technical knowledge and resources, of laboratory and plant facilities, of management, research and engineering.

This great group effort so fully meets the objectives for which the Award for Chemical Engineering Achievement was established in 1933 that the Committee has unanimously agreed to present the 1943 award to the entire American Synthetic Rubber Industry. The editors of *Chemical & Metallurgical Engineering* are pleased to join with these leaders of chemical engineering education in sponsoring, on behalf of the chemical engineering profession, this award to the many corporate groups that have carried the major responsibility for the development of the American Synthetic Rubber Industry.

The primary purpose of this 1943 award will be to signalize the achievements of American industry—particularly those rubber, chemical and petroleum companies that have built and operated the butadiene, styrene, copolymer, butyl, neoprene and thiokol plants

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for CHEMICAL ENGINEERING ACHIEVEMENT

SYNTHETIC RUBBER INDUSTRY

in the Government's synthetic rubber program. Great and perhaps equal credit should be given to those concerns that have contributed most importantly to the process engineering and design of these plants. Included, too, are the companies that have constructed new or expanded facilities for producing essential chemicals, catalysts and feed stocks without which the program would have failed. And, finally, recognition is due the construction companies and the manufacturers of chemical engineering and process control equipment whose joint contributions were essential to the success of the entire project.

To list by name each of the companies that belong in one or more of the foregoing groups is indeed an herculean task and one that lies beyond even the combined knowledge and experience of the Committee of Award. Fortunately, however, the able staffs of the Office of the Rubber Director and the Rubber Reserve Company are available for our consultation and with their cooperation and support, the list is being compiled for publication in our November issue. At that time *Chem. & Met.* will present in an unusually well illustrated article and report, a more detailed explanation of the manner in which these industries have shared their engineering and material resources in building the American Synthetic Rubber Industry.

Respectfully submitted,
SIDNEY D. KIRKPATRICK, *Secretary*
Committee of Award

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NOTE.—The 1943 Award for Chemical Engineering Achievement will be appropriately presented to the American Synthetic Rubber Industry at a subscription dinner to be held in the grand ballroom of the Waldorf-Astoria Hotel in New York City on Wednesday, December 8, 1943, in connection with the 19th Exposition of Chemical Industries. Members of the chemical engineering profession and others interested in celebrating this achievement of American industry are cordially invited to join us on this occasion. For further information, address M. A. WILLIAMSON, publisher, *Chemical & Metallurgical Engineering*, 330 W. 42nd St., New York, 18, N. Y.

WALTER G. WHITMAN, Massachusetts Institute of Technology, Cambridge, Mass.
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MAGNESIUM

Production at the World's Largest Plant

ROBERT H. RAMSEY *Assistant Editor, Engineering & Mining Journal*

Chem. & Met. INTERPRETATION

We have all heard rumors and stories about that plant out in Nevada—Basic Magnesium, Inc. Some have been exaggerations while others, sounding fantastic, have been understatements. In order to get the true story for its readers, our sister publication, *Engineering and Mining Journal*, sent Mr. Ramsey out to Las Vegas last May. His account of construction and operations at BMI appeared in the October issue of *E.&M. J.*, pp. 61-67. The following description is largely abstracted from Mr. Ramsey's article.—*Editors.*

SOUTHERN NEVADA, at first glance appears to be populated at present largely by soldiers, faro dealers, and employees of Basic Magnesium, Inc. In fact, BMI, as it is called down there, takes up more space, is the subject of more gossip, has cost more money, and actually turns out more metal than any other one magnesium plant in the world.

Everything about BMI is colossal. It uses all the peat moss Canada can supply, all the power Boulder Dam can spare, all the men it can get, all the electrical equipment three of our largest companies could manufacture, and it is still growing, although BMI was reported in August to be operating at about 100 percent of capacity. To give you an idea of what this 100 percent means, BMI at full capacity produces over twice as much volume of metal, measured in cubic feet, as one of our larger open-pit copper mines.

It must be admitted, however, that although both Canada and the United States produced some magnesium metal as far back as 1918, Germany has until recently led in magnesium production and technology, chiefly because magnesium is one of the very few metals Germany possesses within her borders. Alloys of magnesium were used by the Germans in the first World War and were manufactured afterward by I. G. Farbenindustrie under the trade name of Elektron alloys, a circumstance to which Basic Magnesium, Inc., owes its existence.

Major C. J. P. Ball, a British officer, became interested in these alloys during the war, and for years thereafter he worked toward forming a company to produce them in England. In 1936 he was successful and Magnesium Elektron, Ltd., was formed, a company which was able to purchase German patent information and which had the benefit of German experience in magnesium production. At present the big MEL plant near Manchester accounts for about 80 percent of English magnesium production.

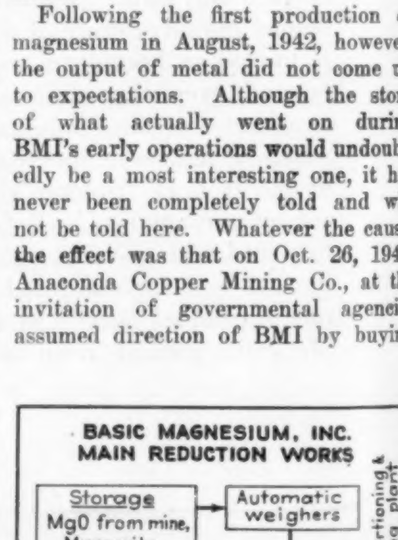
PLANT HISTORY

Basic Magnesium, Inc., was originally the corporate result of a union between Magnesium Elektron, Ltd., who was to furnish the technical know-how, and Basic Refractories, Inc., a Cleveland, Ohio, firm headed by Howard P. Eells, who was to supply the raw material and direct the enterprise. Defense Plant Corp. financed the deal whereby a magnesite deposit in Gabbs Valley, Nevada, owned by Basic Refractories, Inc., would be developed, and a reduction plant erected on a site convenient to Boulder Dam power. The contract was signed on Aug. 13, 1941; a crew of men went into the desert to cut the sagebrush off the proposed plant site in September; foundations were being poured in November; and in August, 1942, magnesium ingots were being produced. Construction work was largely handled by McNeil Construction Co. of Los Angeles, although several other firms assisted in setting up houses, pipe lines, and other jobs.

Plant design was directed by two MEL technicians; Dr. S. J. Fletcher, chief chemist, and J. R. Charles, chief engineer, of the British company. Accompanied by some 3,000 drawings and specification sheets, these two men left England in May, 1941, on a ship which was torpedoed and sunk in Mid-Atlantic. Fletcher and Charles were picked up by other ships in the convoy, but the drawings were lost. Upon arrival in Cleveland on June 3, they cabled to England for microfilm copies of the entire set, the first of which arrived by special bomber on June 7.

At first, Charles and Fletcher were asked to design a plant to produce about 45 tons daily of magnesium, but no sooner had they completed this design than they were asked to more than triple this output. Naturally this involved more than multiplying everything by three and the result was an enormous amount of work handled by these two men under the greatest possible pressure. In three months these men did a job that might reasonably have occupied a year in ordinary times.

Following the first production of magnesium in August, 1942, however, the output of metal did not come up to expectations. Although the story of what actually went on during BMI's early operations would undoubtedly be a most interesting one, it has never been completely told and will not be told here. Whatever the cause, the effect was that on Oct. 26, 1942, Anaconda Copper Mining Co., at the invitation of governmental agencies assumed direction of BMI by buying



the controlling interest held by Basic Refractories, Inc. F. O. Case is now general manager, H. G. Satterthwaite is general superintendent, V. E. MacDonell is chief engineer, all of them Anaconda men. The status of Magnesium Elektron Ltd. was not affected by this change and Charles and Fletcher remain at the plant in their former capacities.

BMI has grown so hugely in the last year and is even now changing in so many details that a description of it is a formidable task. Probably the best place to start is at the mine, some 300 miles north of the reduction plant, located far up on the side of one of those vast Nevada valleys.

Here, 31 miles from the railroad and 1,100 miles by rail from the reduction plant, is a concentration of almost pure magnesite (magnesium carbonate).

Ore sent to the mill must meet certain requirements of composition. It must contain not more than 4 percent insoluble material, 4.5 percent CaO, or 2 percent FeO and Al_2O_3. MgO content should be about 40 percent.

The calcined magnesite is carried to the railroad in trucks with semi-trailers. These have specially-designed bodies made in the form of bottom discharge hoppers, the gates of which are made to fit the unloading bins at both the railroad and the reduction plant. At present the calcines travel 31 miles by truck, then 1,100 miles by rail to reach the plant; but as soon as sufficient trucks are available, the long rail haul will be eliminated, and calcines will be trucked the 300 miles directly to the plant.

There is so much going on in the mile-long beehive of BMI's main reduction plant, and it all sprang out of the desert so fast, that one can't avoid a feeling of unreality as he is shown through the huge buildings. In fact, the structures themselves heighten this effect, for they were designed on modernistic lines totally unlike anything ever before seen in an ordinary mining camp. The comparison has been overworked by this time, but the impression is inescapable that these blocky, broad shouldered buildings must have been erected overnight by a crew of genies of the sort who used to handle Aladdin's construction jobs. He got results by rubbing a lamp; we got BMI by writing a check for a hundred million dollars. Personally, I don't believe in either one of these operations, but the reality of BMI is nevertheless incontrovertible.

Sequence of operations in BMI's main reduction plant is as follows: (1) calcined magnesite, mixed with coal and peat and suitably prepared, is heated in furnaces (called chlorinators) in an atmosphere of chlorine; (2) the anhydrous $MgCl_2$ formed in the chlorinators is transferred to electrolytic cells wherein molten magnesium collects in a pool on the electrolyte's surface; (3) dipped out of the cell by hand, the molten magnesium is then refined and cast into bars. In addition to these main units, the preparation plant, the chlorinators, the cell houses, and the refining plant, the company also operates a chlorine plant, a flux preparation plant, a caustic soda plant, a brine plant, and a $MgCl_2$ liquor preparation plant, most of which are as large as any similar units operating elsewhere.

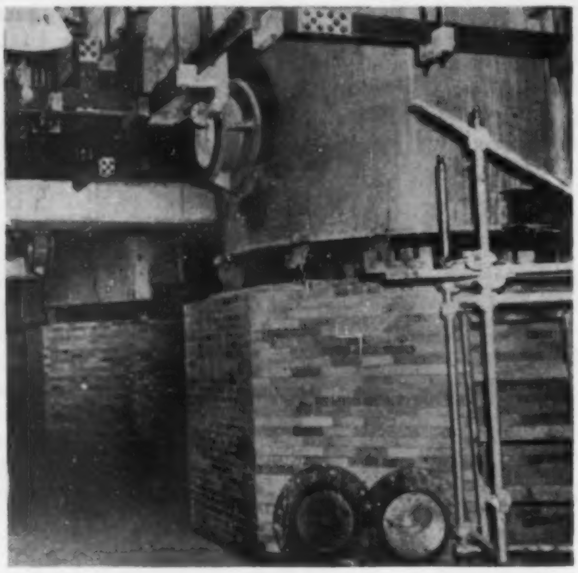
Upon arrival at the reduction works, concentrates are dumped from either truck or boxcar into hoppers from which elevators carry the material into one of five 60-ft. silos, each of which holds about 5,000 tons. For use in the BMI process these concentrates must contain less than 1.5 percent CaO, 1 percent insoluble matter, and 0.5 percent each of FeO and Al_2O_3. Not all the concentrate need be calcined magnesite, however. Up to 75 percent of the concentrate used can be the carbonate, but ordinarily not this much carbonate is used, and magnesium oxide makes up the greater part of the raw material.

The other primary constituents of the feed to the reduction plant are peat moss from Canada, coal from Utah, and certain salts of unspecified composition which assist in the subsequent reactions. Coal acts as reducing agent and peat makes the mixture porous. Incidentally BMI has absorbed a substantial part of Canada's output of peat and will continue to do so until current experiments looking toward the elimination of peat as a necessary constituent are successful. For use in the process, the peat is shredded in a hammermill to minus 8 mesh. The coal and the salts are ground in Raymond pulverizers to minus 200 mesh, and all three ingredients are then stored in small concrete silos.

PROPORTIONING PLANT

These five materials: magnesia, magnesite, peat, coal, and salts, are removed as needed by belt conveyors to the proportioning plant. Here each is weighed out of its respective bin by a Jeffrey feeder and sent by screw conveyor to one of several rotary mixers. From these mixers the charge is fed continuously to several pug mills in which concentrated magnesium chloride solution is mixed with the dry mass until a thick dough has been produced. This magnesium chloride solution is obtained by mixing calcined magnesite with HCl obtained from the chlori-

Magnesium ingots, the finished product, are stacked and stored awaiting shipment



Bottom of chlorinators in which molten magnesium chloride is produced from magnesia, coal and chlorine

Tops of chlorinators, left, include a charging device which minimizes escape of gas. At right are exhaust gas scrubbing towers

nator exhaust gases. Between this point and the chlorination step, two processes are followed. The purpose of each is identical; that is, to dry the dough in pellet form so that it will make a more suitable feed for the chlorinators.

In one part of the preparation plant, the dough from the pug mills is extruded by a screw conveyor through a rectangular 8x10-in. opening and cut into 2-in. bricks which pass on a metal conveyor through a drying oven. They are then loaded on small cars and conveyed through a tunnel kiln, where heat is applied sufficient to cement the mix but not hot enough to more than char the peat in the mixture. These hard blocks are then broken into 2-in. lumps and are ready for the chlorinators.

In the other part of the plant, the dough from the pug mills is fed to rotating cylinders in which the pasty mass is broken and formed into a collection of balls or pellets averaging about an inch in diameter. These pellets are discharged into dryers and then pass into one of four rotary kilns, 100 ft. long. After passing through water-cooled cylinders, the rotary kiln product is ready for the next step.

The pellets of mixed and dried raw material are transported to the chlorinator buildings in trains of small dump cars, each one a kettle-shaped pot holding about 300 lb. of pellets. These chlorinator and electrolysis buildings are the most prominent feature of the BMI plant. Each one covers about the area of a football field and is several stories high. Each building is divided into two main rooms, in one of them are placed eight chlorinators, and in the other and larger room are located 88 electrolytic cells. Before going into more detail about these units, however, it might be well to have a look at the plant now supplying chlorine to the process.

CHLORINE PLANT

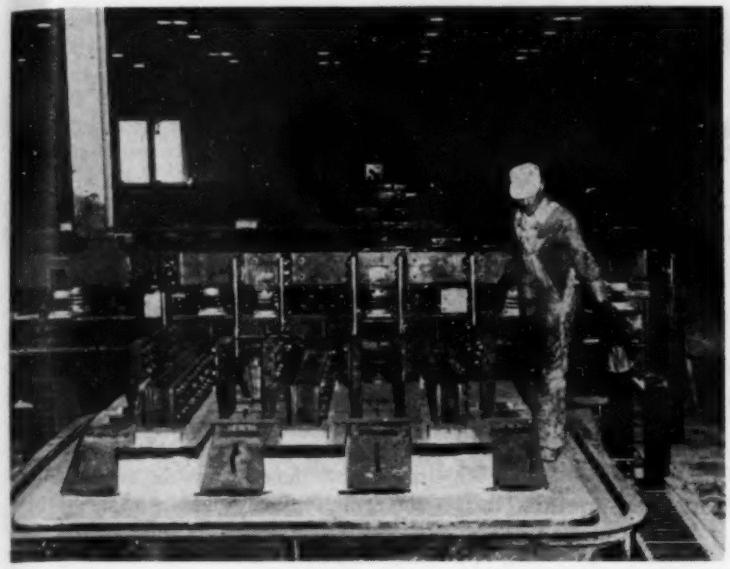
With a capacity of about 200 tons of liquid chlorine per day, BMI's chlorine plant is one of the largest ever built. The Hooker cells are housed in two buildings, 450 in each one. Salt is obtained by special government permission from Death Valley and is dissolved in water in Dorr turbo-agitators. The solution is brought to the proper concentration in large evaporators and is then pumped through the cells. A current of 750 amp. is applied to the cell circuit; voltage drop is about 3.3 per cell. For the present the hydrogen, the hydroxide, and the residual salt are all going to waste pending construction of means for their recovery. Eventually, the hydrogen will be collected for sale, as will the sodium hydroxide. The remaining salt solution will be concentrated and re-used.

Because chlorine is released in the electrolysis of magnesium chloride, most of the chlorine used in the chlorinators will come directly from the cell house, and eventually the chlorine plant will be required only to make up losses in the circuit. When this balance has been attained, BMI will have available for sale much of its liquid chlorine production.

To get back to the chlorinators, to which the chlorine is pumped in the gaseous state; these are cylindrical furnaces about 12 ft. in outside diameter and 25 ft. high, consisting of a metallic shell enclosing a refractory lining. In this shell are a bell and hopper arrangement at the top for introducing the pellets, an inlet for chlorine gas, six openings through which carbon electrodes project into the interior, a port for the removal of waste residues, an exhaust port where gases escape from the furnace, and a tap hole near the bottom where molten $MgCl_2$ is removed.

Operation of these units appears fairly simple. About 300 lb. of fresh dry mix, prepared as outlined in foregoing paragraphs, is dumped into the top of the chlorinator every hour or so, and the accumulated molten $MgCl_2$ is drawn off below, also about once an hour. Inside the chlorinators, the electrodes, arranged in two sets of three each, carry a current which maintains an interior temperature of over 850 deg. C., or sufficient to permit reduction of the MgO contained in the dry mix. Under these conditions magnesia combines with carbon and chlorine to form anhydrous magnesium chloride and carbon monoxide. The molten chloride collects in the lower part of the furnace in a pool. Exhaust gases of the chlorinators carry hydrochloric acid and some magnesium chloride, as well as carbon monoxide. These gases pass through scrubbing towers and various solution tanks in which the HCl and the $MgCl_2$ are dissolved out. The resulting acid solution is then neutralized with calcined magnesite, evaporated to a high concentration, and stored for use in mixing the "dough" which eventually constitutes the chlorinator feed.

Left behind in the chlorinator is a residue composed of silica, alumina, iron oxides, and other impurities. Because these impurities are present in



Cell for production of magnesium. Molten chloride is poured in through small doors in front and metal is dipped out through the same openings

Construction view. Cell tanks are refractory-lined steel arranged in eight rows of eleven

such small amounts, they do not accumulate rapidly and only after about three weeks of operation is it necessary to shut the chlorinator down to clean out these residues. Electrodes are also changed or dressed up at this time.

When it is desired to tap a furnace, a truck-mounted ladle is moved up underneath the tapping point. The clay plug in the tap hole is driven out and a red, liquid, stream of anhydrous $MgCl_2$ pours out. The fluidity of the chloride is rather surprising; it flows and splashes like water in contrast to the behavior of molten metal.

When full (each ladle carries about 2 tons) the car bearing the ladle is driven to the nearby banks of electrolytic cells, each one of which has openings in the top fitted with small doors. These doors are opened in turn, a funnel-like apparatus inserted into the opening, and the molten chloride is poured into the cell through the funnel. A ladle-full suffices to re-fill several cells, and when empty, the ladle is immediately returned to a different chlorinator for another load.

MAGNESIUM CELLS

The cells, arranged in 8 rows of 11 each, are covered receptacles about the size of two bath tubs placed side by side. Tanks are of steel, but the entire lining is of a refractory material. Through the covers of the cells project the electrodes, 6 steel cathodes and 3 graphite anodes, and an exhaust pipe through which chlorine leaves the cell. The gas escapes at the anodes and is caught by shields which enclose the anodes to a depth well below the electrolyte surface. Magnesium metal forms at the unshielded cathodes and gradually collects in a pool on the surface of the chloride. Looking into the cell, one sees the bright-red surface of the molten chloride swirling violently under the pull of the cell's magnetic field. Swept here and there on this surface are numerous shiny globules of metallic magnesium, the drops which eventually coalesce to form a pool of the metal several inches deep. When this condition has been reached, two men dip out the molten metal into a gas-heated ladle for transfer to the first casting operation. Thereupon more chloride is poured into the cell and the cycle is repeated. Magnesium is removed from each cell about once a day.

The impure magnesium taken from the electrolytic cells is carried in the truck-mounted ladle to a row of molds at one side of the cell room. In these molds which resemble oversize dish pans, the magnesium is cast into short cylindrical pigs, each one weighing about 60 lb. These pigs are then removed as needed to the refining plants.

At BMI the electrolytic procedure is simplified to the extent that the chlorinators produce absolutely anhydrous $MgCl_2$. Efficiency of the BMI electrolysis is well over 85 percent, which was the highest mark attained previously.

To supply the 20,000 amp. current required at BMI, both motor-generator sets and mercury-arc rectifier equipment are used, with rectifiers supplying 60 percent of the power. No one manufacturer could have furnished the huge outlay of d.c. equipment required, therefore Westinghouse, General Electric, and Allis-Chalmers combined to fill the order. Total power used in the entire plant is 220,000 kw., enough for a city the size of Los Angeles. In the actual electrolysis, about 8 kwh. are used per lb. of magnesium produced. Power enters the plant at 232,000 volts, is transformed down to 13,800 volts, and the portion used for electrolysis is converted to d.c.

BMI now has a fine new refining plant and others are being built, but in the early hurry-up days of the operation, magnesium was refined "by hand," so to speak, because demand for the metal was so urgent. In fact, one of the original refining plants is still operating in order to keep the flow of magnesium ingots at its maximum, pending construction of a new refining unit.

The new refining unit is housed in a separate building, and in this one unit nearly all of the current output of metal can be refined. Along one side of the central room of the refining plant, large enough to resemble a good-sized copper or lead refinery, is a raised platform built around 11 pot furnaces, heated by oil, and each one holding 2 tons of molten metal. The raw magnesium pigs from the cell houses are melted and purified in these pots. When the sludge has settled to the bottom, the pot itself is lifted bodily out of the furnace by an overhead crane and is transferred to one of three casting machines located along the opposite wall of the room.

These machines consist of an automatically controlled tilting frame to hold the pot of magnesium, and an endless chain of 5-lb. molds to receive the molten metal. The frame is, in fact, a tilting furnace, for it is heated by propane gas in order to keep the metal at the proper temperature dur-

(*Continued on page* 115)

Introduction to High Vacuum In Chemical Industries

THEODORE R. OLIVE *Associate Editor, Chemical & Metallurgical Engineering*

Chem. & Met. INTERPRETATION

High vacuum processing in the neighborhood of 1 micron pressure is beginning to appear in industrial scale chemical engineering processes. As yet the application is relatively small, but the new technique offers such important advantages in working with heat sensitive and high molecular weight organics, and the lower melting metals, that extensive use within a few years seems certain. Conventional ideas on fluid properties and fluid flow, as well as on pumping, no longer hold in the extreme low pressure region. Therefore, the present article surveys these properties, discusses pump performance, and describes the diffusion pump, which is now being built in industrial sizes. A second article, to appear in an early issue, will consider possible applications for extreme low pressure, and will discuss the special techniques required in working at these pressures, as exemplified in the new ferrosilicon process plant for magnesium which is operated at Canaan, Conn., by the New England Lime Co.—*Editors.*

NEW DEVELOPMENTS in high vacuum technology, in the pressure range from a fraction of a millimeter to a fraction of a micron, are on the threshold of becoming important implements in the chemical engineer's kit of tools. Former laboratory techniques in the production of low pressures far below those which can be developed with conventional pumping equipment are now moving into industrial applications, and it is likely that the near future will see the introduction of many new products and improved processes heretofore impossible at the pressures then obtainable. Specifically, in the chemical field, distillation and fractionation of heat sensitive and high molecular weight materials will be practical where distillation was previously out of the question. In metallurgy it is likely that many of the lower boiling metals will be produced from their ores by direct reduction under high vacuum, making them available at lower cost and by simplified processes.

In a few instances pressures in the micron range, or below, are already being used industrially. The oldest example, of course, is the electron tube industry which has dealt with pressures as low as 10^{-8} mm. Hg for about 20 years. Vitamin concentrates have been produced commercially for several years on a large laboratory scale, using distillation under pressures in the micron range (0.001 mm.). Coating of lenses and optical mirrors by condensing thin films of vaporized salts and metals under high vacuum is now being practiced extensively. And recently the first large-scale application of high vacuum reduction of metals has been introduced in the several ferro-silicon plants now making magnesium for use in the war effort.

At pressures where the mean free paths of the molecules in an evacuated space become appreciable in length, the ordinary concepts of fluids and fluid flow become unreliable, and it is necessary for the engineer who is unaccustomed to such low pressures to revise his thinking quite completely. Therefore, while the main purpose of these articles is to deal with high vacuum production and application, it is necessary first to examine the meaning of extreme low pressure and its effect on fluids subjected to it.

According to the kinetic theory of gases, the molecules of a gas are in constant rapid and haphazard motion at all temperatures above the absolute zero. The pressure they exert on the walls of a vessel is directly proportional to the number striking a unit area of vessel wall in unit time, to their average velocity, and their molecular weight. This velocity is proportional to the absolute temperature, and since (by Avogadro's hypothesis) equal volumes of all gases at the same temperature and pressure contain equal numbers of molecules, it follows from the definition of pressure that the velocities of the molecules must vary inversely with their molecular weight, and also that the pressure must be independent of the kind of molecules present, depending only on their number and the temperature.

In high vacuum work pressure is ordinarily expressed in terms of the height of a fluid column which exerts the same force per unit area. By common consent the unit used is a mercury column measured in millimeters of height, low pressures being expressed as fraction of 1 mm. In the present article we are concerned with pressures in the range from, say, 10^{-1} mm. to 10^{-6} mm. The term micron, meaning 0.001 or 10^{-3} mm., is a commonly used unit, in the low-pressure range in question. Table I gives the approximate concentration of molecules and the mean free path of nitrogen molecules at various pressures from atmospheric downward. It will be noted that at pressures in the neighborhood of 1 micron the mean free path is of the same order as the dimensions of piping and equipment, which means that a molecule may travel entirely across a pipe before colliding with another molecule. Under these conditions the ordinary laws of fluid flow are no longer effective, for the transportation of molecules from one point in the apparatus to another is controlled entirely by their natural diffusion, and the mass flow encountered at higher pressures is no longer obtained.

A common misconception regarding the mechanism of evacuation must be dispelled before it is possible to understand fluid flow at extremely low pressures. Ordinarily, it is considered that a vacuum pump "sucks" a vapor or gas

Table I—Mean Free Path of Nitrogen Molecules at Various Pressures

Pressure, Mm. Hg	Number of Molecules per Cc.	Mean Free Path, Cm.*
760 (1 atm.)	2.5×10^{19}	8.5×10^{-6}
1	3.3×10^{16}	6.5×10^{-3}
10^{-3} (1 micron)	3.3×10^{13}	6.5
10^{-6}	3.3×10^{10}	6.5×10^{3}
10^{-9}	3.3×10^{7}	6.5×10^{6}

* At 0 deg. C.

from a space undergoing evacuation. What actually happens, of course, is that as the piston of a reciprocating or rotary pump retreats, it creates an extra space into which some of the gas molecules diffuse as a result of their natural motion. Once in this extra space, and before more than a few have had a chance to diffuse backward out of the space, they are trapped by a valve or by the motion of the piston and are then expelled from the pump cylinder to a region of higher pressure, such as the atmosphere. The mechanism differs somewhat in the case of a centrifugal or jet pump, but the principle remains, namely, that vacuum pumps of all kinds can do nothing more than provide a space into which molecules from the evacuated space can diffuse, where they are then trapped and expelled from the system.

This principle has an extremely important corollary affecting the concept of pumping capacity. Since molecules can enter a pump only by their natural diffusion, then any cause which inhibits their entrance decreases the pump capacity. Resistance of the valve is one such cause. Even more important, perhaps, because it is more easily overlooked, is the capacity for molecular flow of the pipe which connects the pump intake with the evacuated space. Since this capacity varies with the length, diameter and straightness of the pipe, it follows that the pipe should be as large and as short as possible and have a minimum of bends. It is a common misconception, since a high vacuum pump handles only a negligible weight of material, that the size and length of the intake pipe are unimportant. Actually, nothing could be farther from the truth, as this analysis shows. The performance of the evacuating device is completely at the mercy of the connecting pipe.

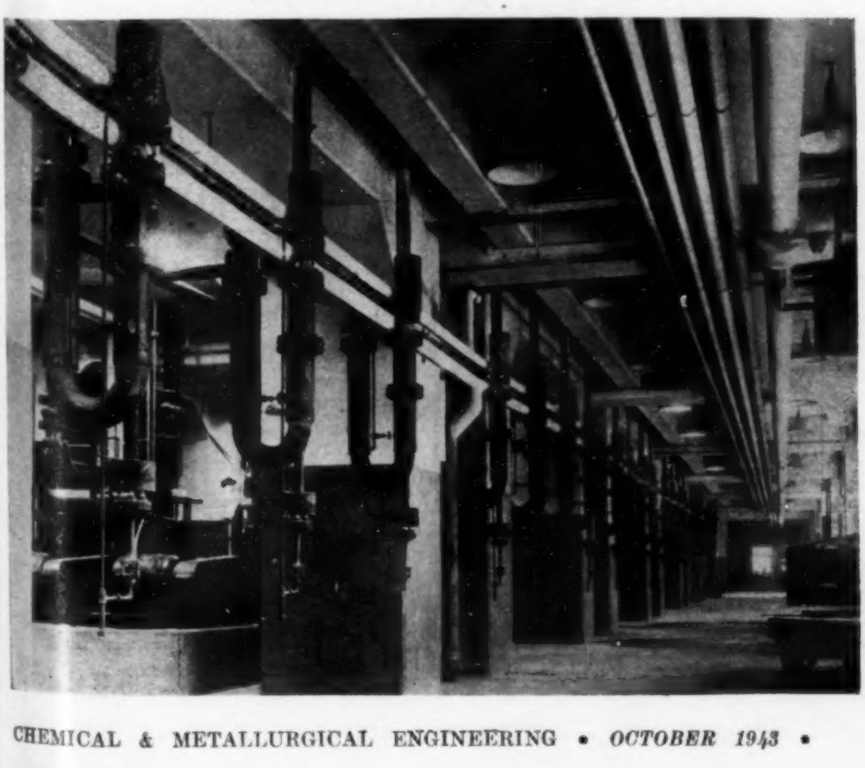
FLUID FLOW

At higher pressures it is usual to consider that a fluid flows from a point of higher pressure to one of lower pressure. Actually, when the mechanism of flow is regarded from the molecular viewpoint, it becomes obvious that the pressure is merely a byproduct of the concentration of molecules and of their velocity, and that flow is only natural diffusion which seeks to equalize the concentration throughout the system. Viewed from this standpoint it becomes apparent that the rate at which molecules can diffuse from a point of higher to a point of lower concentration must depend on the distance they can travel between collisions with other molecules, as well as on the distance they can move before striking a wall. Since their motion is completely haphazard, then a general drift in one direction can be produced only by an excess of collisions behind the moving drift. However, proximity of a wall normal to the direction of drift has an effect similar to a high molecular concentration and tends to cause a cross drift which interferes with the main flow. It is reasonable to suppose, therefore, that the walls of a passage through which molecules are diffusing have a limiting effect on the flow rate over and above the limitation imposed by cross-sectional area, and that the magnitude of this effect is a function of molecular speed and concentration, as well as the area of wall surface.

Actually, this is a fact. Knudsen studied the resistance of pipe to flow of gases at low pressures and found that the character of the resistance introduced by the pipe wall varies with the pressure, that is, with the concentration of molecules. At high pressures the flow may be calculated by conventional methods in terms of length, pressure difference, and a friction factor dependent on the Reynolds number. In the low-pressure range it may be considered that there is a stationary "tube" of molecules of considerable thickness against the pipe wall, the thickness varying in a complex manner with the molecular concentration. The high-pressure concepts of laminar and turbulent flow no longer hold. At pressures in the neighborhood of 1 mm., Knudsen found that the stationary molecule "tube" was relatively thin and that the resistance to flow varied directly as the length of the pipe, and inversely as the fourth power of its diameter. From 1 mm. down to 1 micron, he found the wall interference effect increasing rapidly to a maximum at about 1 to 10 microns, and that the relation between resistance, length and diameter was affected complexly by the concentration of molecules. At still lower pressures, however, where the mean free path becomes comparable to the pipe diameter, he found a decreasing resistance, which may be considered as a reduction in thickness of the tube of stationary molecules. Here the resistance was found to vary directly as the pipe length and inversely as the cube rather than the fourth power of the diameter. The curves of Fig. 2 illustrate the effect of this varying resistance in the cases of ½-in. and 1-in. pipe.

Flow in a low-pressure system is not ordinarily expressed in terms of weight, but, rather, as the volume of molecules at the existing pressure which passes a given cross-section of the conduit in unit time. Flow rate is often referred to as "speed," and its units are usually liters per second, or cubic feet per minute. Thus, the speed of a pump is the volume of molecules it can admit, while the speed of a pipe (Fig. 2) is the volume it can pass, both in unit time. Since flow capacity of a pipe varies inversely with its length, its speed is commonly expressed as volume per unit time and unit length. The total flow resistance of the component parts in a low-pressure system is calculated by adding the

Fig. 1—National Research Corp. mercury diffusion pumps evacuating retorts in the Michigan magnesium plant of Ford Motor Co.



individual resistances exactly as in a series electrical circuit. If $R_1 = 1/S_1$, where R_1 is the resistance of some part of the system and S_1 is its volume flow capacity, or speed, then the resistance of the entire system is the sum of the individual resistances in series, and the reciprocal of the speed of the entire system is equal to the sum of the reciprocals of the speeds of each individual part, or $1/S = 1/S_1 + 1/S_2 + \ldots$, etc.

Obviously, the effective speed of a pump cannot be greater than the speed of the system which it is exhausting. This emphasizes the importance of analyzing carefully the speed of the pipe connection between the pump and the evacuated space, and insuring that its size is great enough and its length short enough to give a speed equal to that of the pump.

VACUUM VAPORIZATION

Since the principal reason for employing extremely high vacuum in industrial chemical processes is to permit the distillation or evaporation of materials which otherwise could not be vaporized at a useful rate, it is necessary to extend the molecular viewpoint used in the preceding section to show how high vacuum makes distillation and evaporation possible. If the liquid is confined in a vessel, molecules will leave the surface and pass into the vapor space until the number returning equals the number leaving, at which time an equilibrium will be reached and the concentration of vapor molecules (vapor pressure) will be a definite value, depending only on the character of the material and its temperature. At any temperature above the absolute zero a definite vapor pressure will be reached, whether or not there are other molecules of an inert gas present in the vapor space.

If some means is provided for drawing off the vapor molecules continuously from the vapor space, vaporization will continue because equilibrium cannot be reached. This vaporization will proceed whether the temperature is low or high, the only effect of temperature rise being to increase the rate of vaporization owing to increased velocity of the molecules. If inert gas molecules are present in the vapor space, however, they will inhibit vaporization, simply for the reason of physical interference with the vapor molecules as they leave the liquid surface and attempt to diffuse away from it.

If the temperature is high enough to give the vapor molecules a vapor pressure equal to the inert gas pressure, and the process is not confined, then the inert atmosphere will be pushed back and vaporization will proceed so rapidly as to be called "boiling." If the vapor pressure is less than that of boiling, even if the process is not confined, diffusion of the vapor molecules outward through the inert molecules will be slow, and vaporization may then not be rapid enough to be perceptible.

There are several ways in which vapor can be drawn off continuously so as to bring about continuous vaporization. It can be done by condensing the vapor molecules on a colder surface (condenser), as rapidly as they diffuse to it from the evaporating surface, as in stills and evaporators; by pumping them from the vapor space, as in jet refrigeration; or by sweeping them away by moving the inert gas, as in spray ponds and cooling towers.

Fig. 2—"Speed" of ¼ and 1 in. pipe at micron pressures

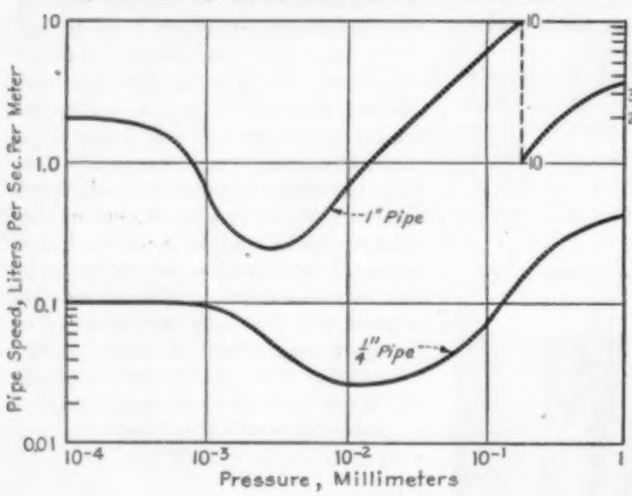


Fig. 3—Piston pump characteristics at low pressures

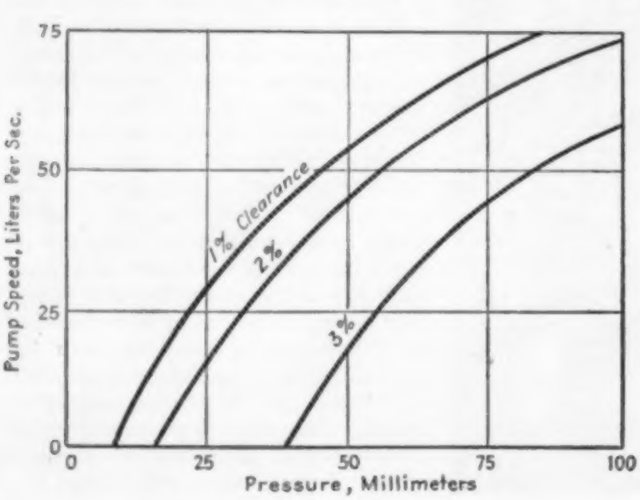


Fig. 4—High vacuum rotary pump "speed" at micron pressures

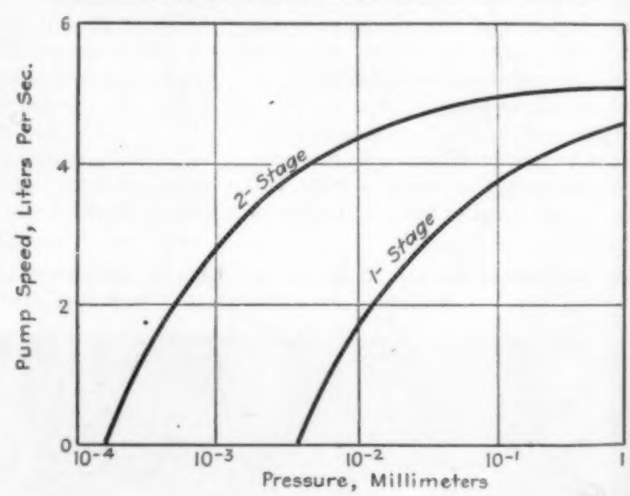
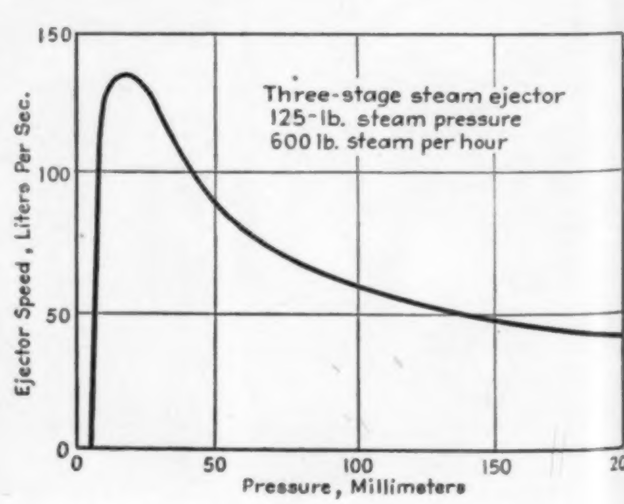


Fig. 5—Three-stage ejector performance at low pressure



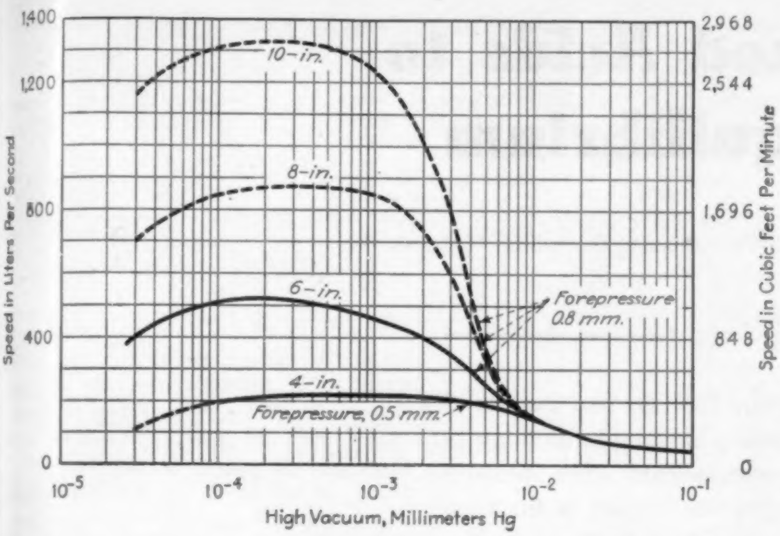


Fig. 6—Characteristic curves of a family of National Research Corp. experimental industrial diffusion pumps in sizes from 4 to 10 in.

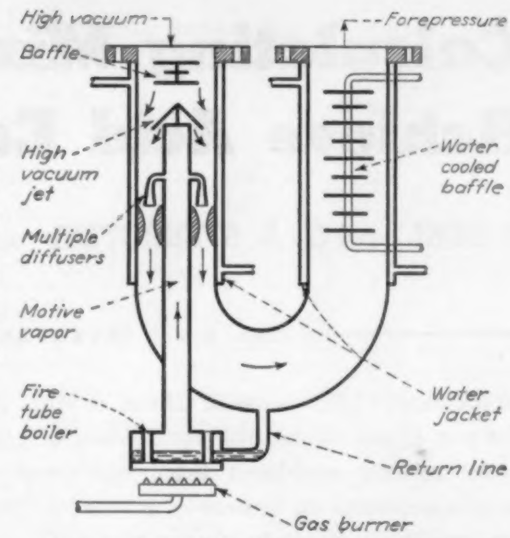


Fig. 7—Typical design of National Research Corp. industrial diffusion pump

With the first two methods, of course, if a high vapor pressure of inert gas is allowed to exist in contact with the evaporating surface, vaporization will necessarily be slow. On the other hand, if the inert gas concentration can be kept low, the inhibiting effect of the inert molecules will be slight. As the inert gas concentration is reduced, the temperature required to maintain rapid vaporization (boiling) can be made progressively lower, until a concentration is finally reached below which no further lowering of the boiling temperature will take place.

It is not generally realized that the boiling point cannot be reduced indefinitely by pressure reduction. Why this should be true is readily apparent, however, from a consideration of Table I. At a pressure of about 1 micron the mean free path of inert gas molecules in contact with an evaporating surface becomes so great that the inert molecules no longer exert an appreciable effect on the rate of vaporization. Hence, nothing is gained in a distillation or evaporation operation by attempting to reduce the inert gas pressure below about 1 micron. On the other hand, it is equally clear that pressures in the micron range are comparable in vaporization operations to theoretical cases where no inert gas exists, and so make possible the continuous vaporization of all materials. If the molecules are extremely large and their velocity at the available temperature is low, the resulting vaporization may be too slow to be of practical value, but it is obvious that the use of such pressures tremendously extends the list of materials that can be vaporized at useful rates. It is equally obvious that a useful rate can be obtained with many materials which are injured by high temperature.

VACUUM PUMPS

Theoretically, there is no reason why mechanical vacuum pumps cannot be used to reach the extremely low pressures discussed here, provided only that their lubricants do not themselves have vapor pressures as high as the pressures to be maintained. Practically, however, mechanical pumps cannot be used for the very low pressure range if there is a continual evolution of inert gas in the system, since it is ordinarily not feasible to attain a sufficiently large displacement rate. This is obvious from the fact that to obtain a displacement of a few hundred cubic feet per minute by means of a reciprocating or rotary piston requires either extremely large size or very high speed. Yet, at micron pressures an almost negligible weight of gas will occupy a tremendous volume. As an example, consider 1 cc. of gas at atmospheric pressure. If the pressure of the gas is reduced to 1 micron, its volume will expand 760,000 times, to 760 liters.

The various types of mechanical pumps have different ranges in which they achieve their best performance. A reciprocating pump, for example, is an efficient device if the pressure is near atmospheric, but operates at low efficiency in a single stage at pressures below about 25 mm. as shown in Fig. 3. Vane type rotary pumps are capable of working at somewhat lower pressures, but still are inefficient even when multi-staged, at pressures below about 10 mm. The oil-sealed rotary eccentric-cylinder high-vacuum pump which has been used so extensively in vacuum tube work is capable of efficient operation well below 1 mm., and in the compound type, as in Fig. 4, can exhaust to less than 10 microns in systems without a continuous evolution of gas.

None of these methods, however, is of sufficient capacity for work at micron pressures when considerable gas evolution is encountered. At such pressures there are totally unexpected sources of gases. All materials contain both absorbed and adsorbed gases which are given off at extremely low pressure, especially at high temperature. Metals, for example, contain a volume of occluded gas (as measured at atmospheric pressure) at least equal to the volume of the metal, and often several times this volume. Many liquids, especially those of high viscosity, can contain enormous quantities of absorbed gases.

Obviously, then, evacuating methods which do not demand a tremendous physical displacement are called for in extreme low-pressure work. Conventional steam jet ejectors are inherently capable of large capacity with moderate size apparatus, as shown in Fig. 5. Furthermore, they are readily operated in multi-stage, frequently having two or three stages, and sometimes as many as five or six. Ejectors with several stages have operated at pressures as low as 25 microns and above, and equally low pressures have been achieved with fewer stages when ejectors were arranged to discharge against low forepressures, such as can be produced by mechanical pumps or water jet ejectors.

Still, steam ejectors of present types are not the answer when pressures of a micron or below are required. Another type of jet device known as the diffusion pump, however, has proven eminently successful, first as a laboratory device, and very recently as a

(*Continued on page* 108)

Calculating Mixed Acids to Achieve Acid Equilibrium

E. BERL and G. A. STERBUTZEL *Carnegie Institute of Technology, Pittsburgh, Pa.*

Chem. & Met. INTERPRETATION

In the April, 1939, issue of *Chem. & Met.*, page 225, Dr. Berl described the use of the Gibbs trilinear system of plotting in the computation of plant mixing problems involving three components. The present article explains an improved method of using this system in the reinforcement of spent nitration mixed acid, so that the resulting quantity of mixed acid equals the original quantity. The method is applicable to rapid routine calculations and should be of great assistance to the nitration industry.—*Editors.*

In nitration operations the spent acid which results not only differs in composition from the original fresh mixed acid, but it is also less in quantity. The ideal method of reinforcing the spent acid is to add nitric acid and oleum in such proportions that the weight (volume) and composition of reinforced acid equal that of the original fresh mixed acid. The solution of this problem is extremely time-consuming by mathematical computation (Berl - Lunge, "Chemisch - Technische Untersuchungsmethoden," 8th Ed., Vol. 2, p. 674) but is readily accomplished graphically through the use of the Gibbs triangle, as shown in Figs. 1 and 2.

In Fig. 1 point *L* represents the composition of the spent acid resulting from a nitration, while *M* is the composition of fresh mixed acid which is to be produced by reinforcement. The ratio of the quantity of spent acid, to the quantity of reinforced fresh acid which is to be produced, is expressed on the chart by the length of line drawn through *M* and *L*. Assume that the fresh acid is 17 units, the spent acid 16 units, and the consumption in nitration 1 unit. Then the line *AML* is drawn so that *AM* equals 16 units (the spent acid); *ML* equals 1 unit (the reinforcing acid to be added); and *AL* equals 17 units (the reinforced acid).

If *M* and *L* are close together, as they are in the nitration of cellulosic materials, it is difficult to draw the line *AML* as accurately as must be done, since the precise location of point *A* is imperative for subsequent steps. Point *A* can be located graphically by magnifying the small triangle 1, 2, 3, in which *M* and *L* are situated, to the size of the entire Gibbs triangle. With this done, points *L'* and *M'* occupy the same relative locations in the whole Gibbs triangle as do points *L* and *M* in the small triangle 1, 2, 3, and the slope of the line *M'L'* is determinable with high accuracy. This magnification of 10 times is readily accomplished by noting that the base of the triangle 1,2,3, represents 10 percent H_2O, its left side 60 percent H_2SO_4, and its right side 20 percent HNO_3. These quantities are subtracted from the coordinates of the points *M* and *L* and the results multiplied by 10, and plotted as *M'* and *L'*. For example, point *L* has the composition 12.5 percent H_2O, 63 percent H_2SO_4, and 24.5 percent HNO_3. The indicated subtraction gives for point *L'* the coordinates (12.5—10) x10=25 percent H_2O; (63—60)x10=30 percent H_2SO_4; and (24.5—20)x10=45 percent HNO_3.

The position of point *A'* is found graphically by means of similar triangles. Owing to the magnification, *M'L'*=10 *ML*. Lay off *M'B* equal to 10 units of any convenient length and extend *M'B* to a length of 16 units. Then draw line *CA'* parallel to the known line *BL'*, thus locating point *A'*. Now, *M'A'*=1.6 *M'L'* or 16 *ML*. Therefore, *AML* can be drawn parallel to *M'A'*, with the length *AM* equal to that of *M'A'*, thus giving the accurate location of *A*.

Point *A* has the property of being the pivot through which all straight lines joining the compositions of possible reinforcing acids must pass if both the composition and the quantity of the reinforced acid are to be correct. It can be considered that there are three "degrees of freedom" in spent acid reinforcing problems, including the composition of the nitric acid (or nitric–sulphuric mixture); the composition of the sulphuric acid (or sulphuric–nitric mixture); and the quantity of mixed acids. As in the case of the phase rule, if two of these "freedoms" are fixed by choice, the third can no longer be chosen freely. Hence, if the quantity of mixed acids is fixed, then the choice of composition of one of the acids to be mixed will automatically fix the composition of the other.

The situation is illustrated by line *NS* on Fig. 1. Point *S*, the proposed composition of sulphuric acid (oleum) to be used might have been chosen at any point along the H_2SO_4–H_2O axis, but to do so would automatically fix the composition of nitric acid to be used as the other end of the straight line *SA* prolonged to the nitric acid side of the triangle. Obviously, since the possible compositions of HNO_3 are limited, this also imposes a practical limit on the composition of H_2SO_4 used. However, it should be noted that the mixing constituents need not be the compositions at the ends of the lines. A mixture of nitric and sulphuric acids and water, such as at point *D*, could be mixed with a mixture of oleum, nitric acid and water, such as *E*, if desired.

As the problem is illustrated in Fig. 1, the chosen oleum composition is 20 percent, or 104.5 percent H_2SO_4. This fixes the nitric acid composition at 89.5 percent HNO_3 and 10.5 percent H_2O. The proportions of acid *N* and acid *S* which must be added are determined by the relations of the length of lines *AS* and *NA*, where *AS* represents the weight of *N*, and *NA* the weight of *S*. The weight can be determined graphically by laying off *FS* equal to the number of units of reinforcing acid needed. Then line *AG*, drawn parallel to *NF*, locates point *G* and *SG* equals the number of units of *N*, and *GF* the units of *S*.

The methods just described can be extended to cases in which it is desired to add more or less reinforcing acid than corresponds to the acid equilibrium. For example, one may wish to eliminate part of the spent acid after each cycle to prevent the accumulation of impurities (nitrosyl-sulphuric acid, oxalic acid, alcohol nitrates, and nitro aromatics) beyond a certain level. In this case an additional amount of reinforcing acid must be used to compensate for the

This work was made possible by a grant to Carnegie Institute of Technology from the Buhl Foundation, for which the authors express their appreciation.

Table I—Summary of Problem With Acid Equilibrium

	HNO_3, Tons	H_2SO_4, Tons	H_2O, Tons
Spent acid, 470.5t	115.3	296.4	58.8
R_2, 13.17t	0.79	13.49[1]	−1.11[2]
N_2, 16.33t	14.02	......	2.31
Total	130.11	309.89	60.0
Resulting composition by graphic method, %	26.02	61.98	12.00
Desired composition, %	26.00	62.00	12.00

[1] (0.94 × 1.09 × 13.17). [2] 13.17 − (13.49 + 0.79).

Table II—Summary of Problem With Acid Excess

	HNO_3, Tons	H_2SO_4, Tons	H_2O, Tons
Spent acid, 458.4t	112.3	288.8	57.3
S_2, 9.7t	......	10.13[3]	−0.43[4]
R_1, 31.9t	17.65	11.04	3.21
Total	129.95	309.97	60.08
Resulting composition by graphic method, %	25.99	61.99	12.02
Desired composition, %	26.00	62.00	12.00

[3] (9.7 × 1.045). [4] (9.7 − 10.13).

spent acid so eliminated. On the other hand, if reinforcing acids which are too strong are used, a deficiency of reinforced acid results. This case is of little practical interest since it is hardly likely that acids of excess strength would be used on account of their cost. However, if such acids were used, the acid equilibrium could be restored by adding fresh mixed acid of composition M, which could be obtained by mixing any combinations of acids on opposite sides of M lying on a straight line through M.

The chart of Fig. 2 shows the same problem as Fig. 1, except that the line AML has been extended downward toward point B in the "supernitric*" region. The line is then calibrated to show excess or deficiency of spent acid. Compositions falling on lines passing through A achieve the acid balance, while those falling on lines below A, such as point D, give a deficiency of reinforced acid, and those falling on lines above A, such as point C, give an excess of reinforced acid. The calibration may be accomplished by using the equation

$x = 100(1-ky) / (y + 1)$, where x is the percentage excess or deficiency of spent acid (a plus sign representing an excess, and a minus sign a deficiency); k is the ratio of the weight of reinforced acid to weight of spent acid, in this case $17/16=1.0625$; and y is the ratio of MC to ML, where C is any point along BL through which the line connecting the compositions of the acids to be mixed may pass.

The figures used in setting up Fig. 2 include the following compositions:

Components	Spent Acid L	Fresh Acid M
H_2SO_4	63	62
HNO_3	24.5	26
H_2O	12.5	12

The original quantity of fresh mixed acid is 500 tons, the loss in the process 29.5 tons, and the quantity of spent acid 470.5 tons. Therefore, $k=500/470.5 = 1.0625$ and $ML=AL/17=AM/16$.

As has already been pointed out, the exact location of point A is of great importance. Furthermore, all acid compositions on a line through A, when on opposite sides of A, can be mixed to give the acid equilibrium; while acid pairs on the opposite sides of LAB, which are connected by a line intersecting above or below A, give an excess or deficiency, respectively, of nitrating acid mix. The three possible cases then include:

1. Acid equilibrium.
2. Reinforcing acid excess, in which case some spent acid must be eliminated to produce the desired quantity of reinforced acid.
3. Reinforcing acid deficiency, in which case fresh acid of composition M must be added to produce the desired quantity of reinforced acid.

Case 1, Acid Equilibrium—Spent acid of composition L, to the extent of 470.5 tons, is to be reinforced so that 500 tons of reinforced acid of composition M results. This can be done by the mixing of acid pairs on the opposite sides of A which fall on any line through A. For example, if oleum of composition R_2 is selected, consisting of 94 percent of 40 percent oleum and 6 percent of HNO_3 (which has a freezing point of −23 deg. C.), then nitric acid of composition N_2, consisting of 85.8 percent HNO_3, must be used (or some composition falling along N_2A. The 29.5 tons of total reinforcing acid will consist of $(29.5 \times N_2A/N_2R_2)=13.17$ tons of R_2 and $(29.5 \times AR_2/N_2R_2=16.33$ tons of N_2. Table I shows a summary and check of these figures. It will be observed that the accuracy possible with a Gibbs triangle of usual size (11.5 in. on a side) is greater than the accuracy of the data, which introduce errors owing to the difficulty of securing representative samples for analysis.

Similar results can be obtained if, for example, oleum of composition F (111 percent H_2SO_4) is substituted for R_2. In this case, 12.22 tons of F would be added to 17.28 tons of N_2 to attain the desired mixture.

Instead, if reinforcing acid of com-

* Supernitric acid has been prepared by dissolving the anhydride of nitric acid, N_2O_5, in water-free HNO_3. This acid, which has advantages that doubtless will sometime make it commercially available, is comparable to oleum which is a solution of the anhydride of sulphuric acid in water-free sulphuric. Like oleum, it can be considered as more than 100 percent of the acid.

Fig. 1—Graphical method of calculating reinforcing acids to attain acid equilibrium

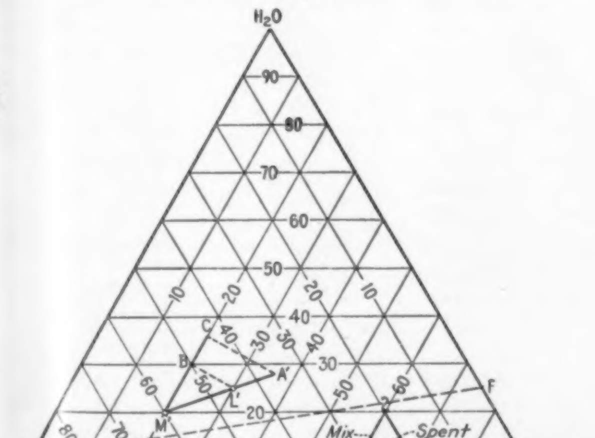


Fig. 2—Development of graphical method for problems where spent acid is in excess, deficiency or equilibrium

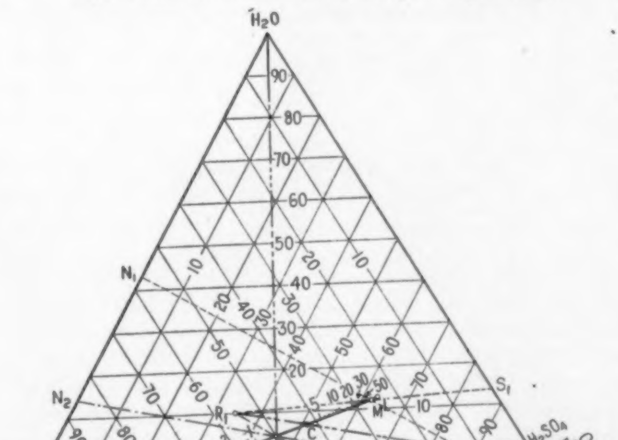


Table III—Summary of Problem With Acid Deficiency

	HNO_3, Tons	H_2SO_4, Tons	H_2O, Tons
Spent acid, 470.5 t	115.3	296.4	58.8
H_2SO_4, 7.16 t; HNO_3, 12.34 t	12.34[b]	7.16[a]	.....
L (to make up deficiency), 10 t	2.45	6.3	1.25
Total	130.09	309.86	60.05
Resulting composition by graphic method, %	26.02	61.97	12.01
Desired composition, %	26.00	62.00	12.00

[a] (19.5 × 36.7/100). [b] (19.5 × 63.3/100).

position E is available (47.8 percent H_2SO_4 and 52.2 percent of HNO_3) the desired mixture could be made from 28.23 tons of E and 1.27 tons of water, as shown by the line E–H_2O.

One further example is the use of 11.98 tons of a mixed acid of composition of R_1 (55.3 percent HNO_3, 34.6 percent H_2SO_4 and 10.1 percent H_2O) mixed with 17.52 tons of water-free mixed acid of composition NS (46.5 percent HNO_3, and 53.5 percent H_2SO_4).

Case 2, Acid Excess—If a mixture were made consisting of 470.5 tons of spent acid L, with reinforcing acid R_1 (34.6 percent H_2SO_4, 55.3 percent HNO_3, and 10.1 percent H_2O) and S_2 (104.5 percent H_2SO_4), the line R_1S_2 shows (where it crosses the excess scale AL at C) that an excess of 2.5 percent of reinforced acid would result, and that 2.5 percent of the spent acid must be eliminated. The spent acid L to be used, therefore, is $470.5 \times 0.975 = 458.4$ tons and the reinforcing acid is $500 - 458.4 =$ 41.6 tons of R_1 and S_2. The required quantity of R_1 is $(41.6 \times CS_2/R_1S_2) =$ 31.9 tons, and of S_2 is $(41.6 \times R_1C/R_1S_2)$ $= 9.7$ tons. Table II shows a summary and check of these figures.

Case 3, Acid Deficiency—If a mixture composed of 100 percent HNO_3 and 100 percent H_2SO_4 should be used for reinforcement of 470.5 tons of spent acid of composition L, the intersection D of the line HNO_3–H_2SO_4 with the deficiency scale AB, shows that a deficiency of 2.1 percent would result. Instead of 470.5 tons of spent acid, $470.5/(100 - 2.1) = 480.5$ tons should be used, to which $500 - 480.5 = 19.5$ tons of the correct mixture of 100 percent H_2SO_4 and HNO_3 should be added to produce mixed acid of composition M. This is accomplished by adding to 470.5 tons of spent acid of composition L a mixture of $(19.5 \times 36.7/100) = 7.16$ tons of 100 percent H_2SO_4, and $(19.5 + 63.3/100) =$ 12.34 tons of 100 percent HNO_3. However, this mixture will amount to only 490 tons, so 10 tons of acid of composition L must be added. Since the above calculation is based on 480.5 tons of spent acid, and only 470.5 tons was recovered, the remaining 10 tons of L may be made of fresh acids. The mixture may be made of H_2SO_4 and HNO_3, or of H_2SO_4 — HNO_3 mixtures which are on opposite sides of a line through L.

If the spent acid contains impurities which do not contribute to the nitration process, the analytical value of these impurities (for instance, nitrosyl-sulphuric acid, SO_5NH, and organic materials like oxalic acid, glycerine mono- and dinitrate, etc.) must be subtracted from 100 and the analysis recalculated to 100 percent for the sum of the percentages of H_2SO_4, HNO_3 and H_2O. For example, with 5 percent impurities and 23.3 percent HNO_3, 59.8 percent H_2SO_4 and 11.9 percent H_2O, the effective percentage of HNO_3 is $23.3/0.95 = 24.5$ percent HNO_3; of H_2SO_4 is $59.8/0.95 = 63.0$ percent H_2SO_4; and of H_2O is $11.9/0.95 = 12.5$ percent.

The graphic method described above is rapid in use and avoids the errors that are readily made in computations. Furthermore, it has the great advantage of permitting the discovery of optimum reinforcement conditions under any set of circumstances.

HIGH VACUUM

(*Continued from page* 105)

large capacity pump for industrial operations. (See Fig. 6.) In fact, there is no theoretical reason why diffusion pumps of any desired capacity (speed) up to many thousands of cubic feet per minute cannot be built. Pumps already built have capacities as high as 30,000 cu.ft. per min. at pressures as low as 10^{-4} mm. and there is no reason why pumps of several times the diameter and many times the capacity cannot be constructed if the demand for them should arise.

HOW DIFFUSION PUMPS WORK

The diffusion pump was developed by Langmuir in the United States about 1913, and by Gaede in Germany at about the same time, or shortly thereafter. In the earlier types, and, in fact, until quite recently, such pumps were always constructed of glass and hence were not adapted to large size. In the early pumps mercury vapor was the motive fluid, and it is still used to a considerable extent owing to the small and simple boiler required, compared with other fluids which can be used. However, certain hydro-carbon oils and other high-boiling organic liquids have been used successfully and offer advantages under proper operating conditions, in that they are of lower vapor pressure than mercury and hence are capable of working at even lower pressures.

In its simplest form a diffusion pump consists merely of a water-jacketed tube in which a number of jets of the motive vapor issue radially from holes in a central pipe beneath a conical umbrella which directs the jet downward and toward the walls of the tube, as in Fig. 7. As molecules of the gas which is being evacuated diffuse into the curtain of motive vapor they are mechanically entrapped and moved beyond the curtain which has, of course, a component of motion in the desired direction. This is not to say that molecules of the gas cannot diffuse backward through the curtain, for some of them do, but about half of those which diffuse through do not return and the concentration below the curtain increases to the point where it is possible to remove the molecules from the system by means of a mechanical pump or steam ejector. Meanwhile, the curtain of motive vapor, having accomplished its purpose, reaches the water-cooled wall and condenses, flowing back to the boiler where it is re-vaporized for return to the jet. Pumps with only the umbrella type of jet are capable of operating at extremely low pressure, for example, at 10^{-7} mm. or even lower, using a low vapor pressure oil and properly designed baffles to prevent the motive vapor from backing up into the evacuated space, but they cannot operate with forepressures higher than about 0.25 mm. Therefore, the mechanical pump or jet which is used to discharge the trapped molecules must be capable of high efficiency at a relatively low pressure. Much higher forepressures are made possible by combining the umbrella type of diffusion pump with a stage of ejector type jets as shown in Fig. 7. Oil vapor pumps with such jets can operate at forepressures of several millimeters, and mercury pumps of this type at forepressures as high as 25 mm. No diffusion pump, however, can discharge directly to the atmosphere, all requiring operation in series with a mechanical pump or another ejector. All diffusion pumps require an efficient condensing arrangement for the motive fluid to prevent its loss in the form of vapor, along with the gas being evacuated. Mercury pumps, for example, require cooling water at a temperature below about 80 deg. F., if loss of mercury is to be avoided. Some of the higher boiling organics can be condensed with higher temperature water, so their use may be indicated where a reliable source of low-temperature water is not available.

In the preparation of this article and its drawings, as well as a second article which will follow in a later issue, to deal with applications of extreme high vacuum in the industrial field, the writer was given much valuable assistance by Richard S. Morse, president of the National Research Corp., Boston, for which acknowledgment is hereby made.

More Synthetic Resins from Rosin

JOHN R. CALLAHAM *Assistant Editor, Chemical & Metallurgical Engineering*

Chem. & Met. INTERPRETATION

Many are the wartime achievements of the commercialized "master" pilot plant of Hercules Powder Co. at Mansfield, Mass., the "finishing school" from which rosin-derived resins are graduated into full-scale commercial production. Soon to be an alumnus of this plant is Pentalyn M, a modified pentaerythritol ester of rosin widely used for military and essential civilian purposes which, at the same time, is contributing to the conservation of critical drying oils, phenol and glycerol. Another wartime contribution is the pentaerythritol plant built almost entirely from reconditioned equipment.—*Editors.*

Only about ten years ago there was little market in this country for rosin esters other than ester gum, and it was actually not until 1932 that Hercules Powder Co. began pilot plant production of Abalyn, the methyl ester of rosin, and of Hercolyn, the hydrogenated methyl ester. Since that time, however, a continuous series of new synthetic rosin esters and other derivatives has been developed.

While the principle of esterifying rosin with glycerol to make ester gum is not new, the commercial availability of a variety of other rosin esters is very recent indeed. Rapidly changing demands for new and unusual properties in adhesives, coatings, and plastics have made necessary the "tailor-making" of rosin esters, not only by widening the selection of esterifying alcohols but also by operation on the rosin nucleus itself and by addition of other resinous compounds, such as alkyds or phenol-aldehyde condensates.

MANSFIELD PLANT

It was in 1941 that engineers of Hercules Powder Co. realized the advantages of setting up a master pilot plant for working out processes for various synthetic resins which would, at the same time, produce at a sufficient rate to allow establishment of the products on the market. It was in that same year that Hercules purchased for this very purpose the Mansfield, Mass., plant of John D. Lewis, Inc., producer of Lewisol resins.

Engineers immediately set about to modify this unit toward maximum flexibility for experimental purposes and at the same time toward a size large enough for small-scale commercial production. The result is a unit which is more than a pilot plant and yet which is far more flexible than the ordinary semi-commercial plant, since any Hercules rosin-derived resin can be made here in large salable quantities by simple adjustments in equipment and processing variables. Actually, the term "commercialized master pilot plant" would probably be most descriptive of the unit.

In close connection with this master pilot plant and contributing to its operation, is the pentaerythritol plant at Mansfield. Manufacture of pentaerythritol, vital raw material in this war, was carried over from laboratory-scale preparations to a larger scale production in equipment which was entirely non-critical and chiefly second-hand. Pentaerythritol production began in early 1943, and since then most of the processing tangles have been unravelled.

Now, two years after the Mansfield unit was taken over, actual resin output has been increased several fold by making minor changes in existing equipment and without losing any production during the conversion. Needless to say, the plant is now operating at maximum capacity, largely in the manufacture of Pentalyn resins.

PENTALYN RESINS

Among the first rosin resins to be graduated from the Mansfield "finishing school" into full-scale commercial production at this concern's Brunswick, Ga., and Hattiesburg, Miss., plants were Pentalyn A, G, and X. These resins were introduced on the market early in 1940, although development work was started in the middle 20's.

Pentalyn resins, products of the esterification of rosin acids with pentaerythritol, have a molecular weight about 30 percent greater than the analogous glycerol ester of rosin and a melting point roughly 25 deg. C. higher. Since pentaerythritol is tetrahydric, its rosin esters may be expected to differ from the esters of glycerol, which is trihydric. The architectural pattern of the pentaerythritol tetra-abietate molecule differs greatly from that for glycerol triabietate, and early experimental work on pentaerythritol explosives has shown without any doubt that the former type of structure is much more stable than the chain structure of glycerol.

Regardless of the explanations of this difference in behavior, it is a fact that Pentalyn resins are enabling varnish makers to utilize the less critical drying oils to make quick-drying varnishes for a variety of military and

General view of a part of the Mansfield, Mass. plant of Hercules Powder Co., "finishing school" for synthetic resins derived from rosin

Table 1—Physical Properties of Synthetic Resins Produced from Rosin

Trade Name	Type of Rosin Derivative	Acid Number	Color Rosin	Color Lovibond	Melting Point, deg. C.
Abalyn	Methyl ester	8[2]	——	20A or less	Viscous liquid
Hercolyn	Hydrogenated methyl ester	8[2]	——	8A or less	Viscous liquid
Flexalyn[1]	Diethylene glycol ester	5–10	——	20–40A	45–50
Flexalyn C[1]	Ethylene glycol ester	4–8	——	20–40A	63–68
Staybelite Ester No. 10	Glycerol ester of hydrogenated rosin	10[2]	N[2]	——	83–86
Staybelite Ester No. 1	Ethylene glycol ester of hydrogenated rosin	12[2]	N[2]	——	55–58
Staybelite Ester No. 2	Diethylene glycol ester of hydrogenated rosin	10[2]	N[2]	——	38–45
Pentalyn A	Pentaerythritol ester	19[2]	——	25–38A	110[3]
Pentalyn G	Pentaerythritol ester	19[2]	——	25–39A	131[3]
Pentalyn X	Pentaerythritol ester	15	——	35A	155[3]
Pentalyn M	Phenolic modified pentaerythritol ester	25[2]	H–M	——	165[3]
Poly-pale Ester Gum	Glycerol ester of polymerized rosin	8–10	WW–WG	——	116–118
Poly-pale Ester No. 1	Ethylene glycol ester of polymerized rosin	8–10	——	40–45A	80–85
Poly-pale Ester No. 2	Diethylene glycol ester of polymerized rosin	10–12	——	60A	61
8L Ester Gum	Glycerol ester of pale wood rosin	6–8	WG–N	——	92–96
Vinsol Ester Gum	Glycerol ester of Vinsol resin	6	Black		144–148
Lewisol 2L	Maleic alkyd-modified ester	15[2]	M–WG	20–45A	130–140
Lewisol 28	Maleic alkyd-modified ester	40[2]	M–WG	25–49A	140–150
Lewisol 33	Maleic alkyd-modified ester	40[2]	N–M	28–49A	152–168
Lewisol 8S	Maleic alkyd-modified ester	230–250[4]	M–K	——	112–114
Neolyn 20	Modified alkyd resin	10–15	N–WG	25–40A	72–78
Neolyn 40	Modified alkyd resin	20–25	N–WG	25–40A	Balsamic

[1] Offered in solid form or 80 percent in mineral thinners. [2] Max. [3] Min. [4] Benzene-alcohol solvent.

essential civilian uses. Furthermore, in cases where special properties of viscosity and through-dry are demanded, no glycerol whatsoever and little phenolic modifier are necessary. These resins are, therefore, a boon to the conservation of considerable phenol and of glycerol in alkyds and in phenolic-modified ester gum.

Latest of the pentaerythritol rosin esters is Pentalyn M, designed to give tougher through-dry with linseed oil without sacrificing the speed of top-dry. Although a modified phenolic resin, this is a low consumer of phenol among resins of equivalent viscosity characteristics. It does not contain any glycerol whatsoever.

At present, Pentalyn M is produced solely at the Mansfield plant, although it is now ready to be "graduated" into large-scale commercial production at the company's southern plants where equipment is now actually being installed for this purpose. The outstanding advantage of these locations, of course, is that molten rosin is directly available for resin manufacture.

Raw materials for production of Pentalyn M are rosin, pentaerythritol, and a small amount of phenol-formaldehyde condensate. Pentaerythritol is commonly produced by reacting about four equivalents of formaldehyde in warm aqueous solution, in the presence of lime, with one equivalent of acetaldehyde. One equivalent of formaldehyde actually acts as a reducing agent and is oxidized to formic acid. Calcium is precipitated by means of sulphuric acid, the mixture filtered, and the filtrate concentrated and crystallized by evaporation in vacuum.[1]

A section of the upper level of the gum room where pentaerythritol esters of rosin are made by means of a simple esterification reaction

PENTALYN M PLANT

Rosin for Pentalyn M production is first shovelled by hand into a melter. Here, with the aid of steam coils, it is melted and flows into a small heated reservoir. The molten rosin is filtered and pumped into an insulated tank held at about 160 deg. C. by steam to prevent solidification.

Molten rosin, automatically weighed, solid pentaerythritol, and liquid phenol condensate are charged into an esterification kettle provided with coils through which is circulated a hot petroleum-base oil to heat the charge. The cook is continued until the desired acid number is reached, which is 25 for Pentalyn M.

Rosin acids, of which abietic acid is the most important, constitute about 90 percent of refined wood rosin. Some 90-95 percent of these acids are esterified by pentaerythritol during the cooking, the completeness of the reaction being determined largely by the acid number desired in the final resin. The unreacted acids remain in the resin, but the 10 percent non-acidic constituents of the rosin are mostly distilled out during esterification.

After cooking is complete, the liquid resin is dumped through a bottom discharge valve directly into fiberboard drums, where it is allowed to cool and solidify. Each of the discharge valves is provided with an exhaust system to remove any fumes released.

One of the boilers for heating the circulating oil is coal-fed, while the other uses fuel oil. The conversion to coal, made several months ago, was completed within 12 hours. This boiler is fed pulverized coal continuously by means of a screw, the rate of which is thermostatically controlled.

Pentalyn M, as well as the other Pentalyn resins, is used by the Army and Navy in coatings for shells, maintenance finishes for buildings and machines, insulating varnishes, aircraft wing and body finishes, flameproofing and waterproofing tents and tarpaulins, for the hulls, interiors, and decks of cargo ships and, in Canada, for

[1]T. L. Davis, *Chemistry of Powder and Explosives*, Vol. II, pp. 278-79, John Wiley & Sons 1943.

tank finishes and other similar military equipment.

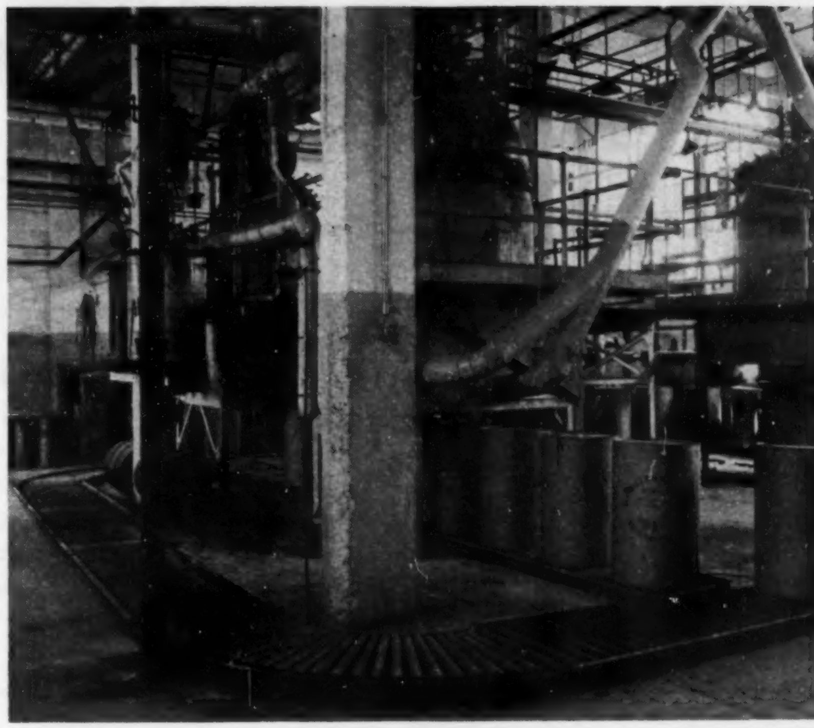
These resins have proven satisfactory in the field of maritime finishes, in paints for priming the hulls of ships. Such paints must be hard, yet flexible, non-cracking or scaling and extremely durable. Formerly, many of these qualities were obtained in maritime paints through the use of imported tung and other oils. Pentalyn M is particularly adapted for varnishes that must be resistant to salt spray.

NEOLYN RESINS

This Mansfield unit also contains an experimental alkyd resin plant and a small alkyd pilot plant. The former is now in full-scale production on the newest development in the Hercules resin line, the recently announced Neolyns. Neolyn 20 and Neolyn 40 are alkyd-modified synthetic resins which, under ordinary conditions, are thermoplastic and film-forming. Neolyn 20 is a solid having a melting point (Hercules drop method) of 72-78 deg. C., and an acid number of 10-15; Neolyn 40 is balsamic, tacky and has an acid number of 20-25.

Neolyns are not as yet in full-scale production and their applications are currently just emerging from the experimental stages. However, it seems that these resins will be of considerable interest in hot melt applications and in solvent solution coatings in which thermal stability or heat-sealing may be of value. For hot melt applications, they possess exceptionally high gloss and greaseproofness. Neolyn 40 is a satisfactory plasticizer for Neolyn 20 and other materials.

It should be noted that the Mansfield unit was redesigned to provide for three primary conditions: (1) a commercialized "master" pilot plant; (2) a starting point for preparation of resin raw materials (in the main a postwar project, although pentaerythritol is now in production); (3) location for a smooth-functioning technical service laboratory.



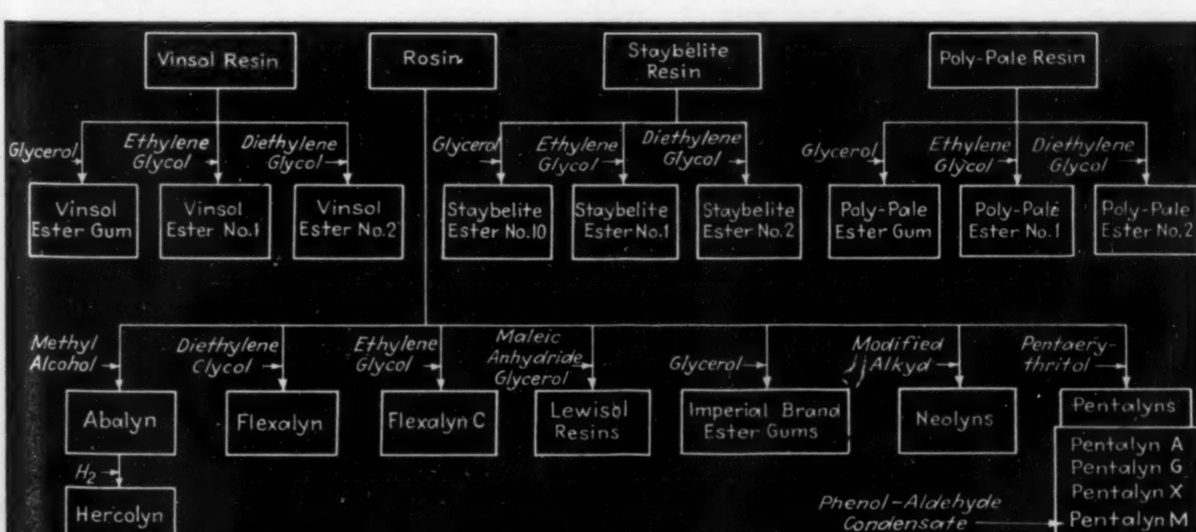
A section of the lower level of the gum room, showing the roller conveyor system and fiberboard drums filled with finished pentaerythritol resins

TECHNICAL SERVICE

This idea for a technical service laboratory was conceived early in 1942, and work was begun on isolating a section of the building for activity, independent of production, on oleoresinous and alkyd developments, chiefly in the paint and varnish field. By late 1942, the Synthetics Department had set up a group of specialized chemists and chemical engineers in this new laboratory. Since then, facilities have been further improved from time to time.

The combined laboratory control and technical service staffs at Mansfield have been expanded seven times their original size, and plans for further expansion are now under consideration. The policy of employing women in war work is applied in this laboratory, and women now make up about 35 percent of the total technically trained personnel.

Flow chart showing basic raw materials and relationships of the rosin-derived synthetic resins now being produced



Demineralizing Industrial Water And Process Liquors

ESKEL NORDELL *Technical Dept., The Permutit Co., New York, N. Y.*

Chem. & Met. INTERPRETATION

Applications of ion exchange reactions are relatively new in the process industries and offer much promise for the future. In this article, the author traces the main developments which have taken place in this field, putting particular emphasis on the latest accomplishment which permits complete demineralization by ion exchange. Although many of the details cannot be published yet because of the use of this process in the war effort, enough is said here to start process engineers thinking of the possibilities which this process opens up.—*Editors.*

Many industrial wet processes require water which is free from the various mineral salts ordinarily present in practically all natural water supplies. Until recently, the costly method of distillation was the only known way for producing water of such a character. Now, however, water may be demineralized by a simple and relatively inexpensive ion exchange process, in which raw water at ordinary temperatures is passed first through a hydrogen cation exchanger and then an anion exchanger, or acid absorbent. The net result is an effluent which compares favorably in quality with distilled water.

Synthetic organic cation and anion exchangers developed for, and used in this process, are also finding uses in fields other than water treatment. They are now important in the recovery of valuable electrolytes which are present in dilute solutions; the removal of small quantities of ionic impurities from low cost products; the separation or fractionation of (a) electrolytes from non-electrolytes, (b) strong electrolytes from weak electrolytes, (c) multi-valent ions from ions having a different valence, (d) monoatomic ions of low atomic number from those of high atomic number; for actions of catalysis; and for scrubbing gases.

CATION EXCHANGE WITH ZEOLITES

In the familiar sodium zeolite process, hard water is softened by simply passing it through a bed of granular sodium zeolite which has the ability to abstract calcium and magnesium cations from the hard water and replace them with sodium cations. Thus the bicarbonates, sulphates and chlorides of calcium and magnesium present in hard water are transformed by the softening process into the corresponding salts of sodium. It is evident that this method does not reduce the total number of ionic constituents present.

Zeolites used in this process are certain double silicates which may be represented by the general formula $Na_2O, Al_2O_3 (SiO_2)_x, (H_2O)_n$ where x represents from 5 to 13 molecules of SiO_2, and n stands for a rather indefinite amount of water of hydration. Hydrogen cation exchange with siliceous zeolites is impractical because a regenerating acid would decompose the zeolite.

ORGANIC CATION EXCHANGERS

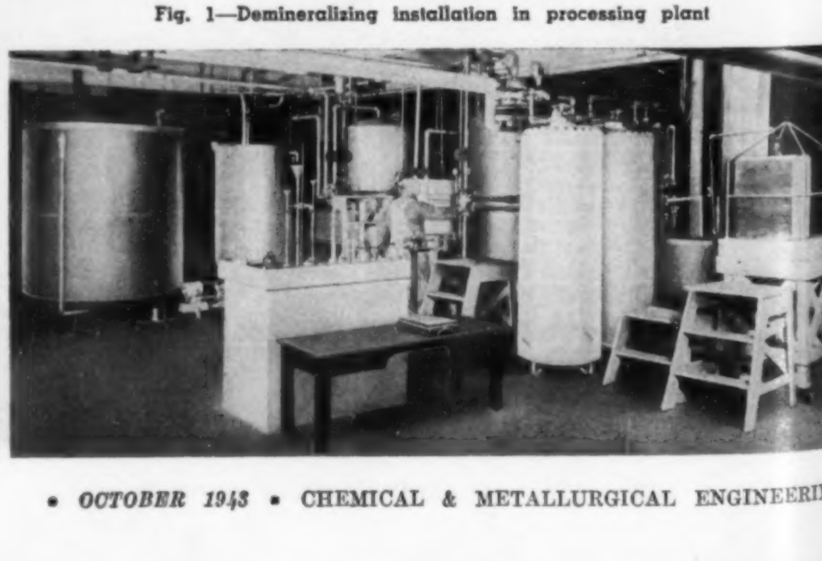
With the advent of organic cation exchangers, this latter limitation was removed. Organic cation exchangers are synthetic materials which not only are capable of carrying out all of the cation exchanges which may be effected with the siliceous zeolites, but in addition may be used to exchange hydrogen ions for metallic ions. Utilization of this fact constitutes the first step in demineralization.

The coal derivatives, such as Zeo-Karb, were the earliest organic cation exchangers developed and have been most extensively applied in practice. Zeo-Karb installations have been operating for a number of years and for thousands of cycles without deteriorating physically, dropping in capacity, or developing colored effluents. It appears that although some resins are slightly higher in capacity, a good sulphonated coal is more resistant and has greater stability. In physical properties, Zeo-Karb is a hard, black, granular material which weighs approximately 30 lb. per cu. ft. when shipped.

When regenerated with sodium chloride the principle advantage of these organic cation exchangers over zeolites is that, being non-siliceous in nature, they eliminate the danger of silica pickup by the water being softened. They do not, of course, reduce the total mineral salt content, but act similarly to the zeolites.

When an organic cation exchanger is regenerated with an acid, such as sulphuric acid, instead of sodium chloride, it acquires replaceable hydrogen ions. The Zeo-Karb material, when so regenerated, is known as Zeo-Karb H whereas, when regenerated with sodium chloride, it is known as

Fig. 1—Demineralizing installation in processing plant



Zeo-Karb Na. Water containing mineral salts, when passed through a bed of the Zeo-Karb H, loses metallic ions to the Zeo-Karb and gains hydrogen ions in exchange. In this manner, not only are the cations of calcium and magnesium removed but also the cations of sodium or any other metallic cation present.

Since hydrogen cations are given up in exchange for the other cations, this results in the formation of equivalent amounts of acids corresponding to the anions present in the raw water. Thus sulphates are transformed to sulphuric acid, chlorides to hydrochloric acid and bicarbonates to carbonic acid. In the latter case the carbonic acid formed immediately breaks down into free carbon dioxide and water. Therefore, with a water that contained nothing but bicarbonates, this process would provide an effluent containing only carbon dioxide, easily removable by aeration, so that the net result would be an effluent comparable to distilled water in quality.

Since sodium bicarbonate would be removed in the same manner as the bicarbonates of calcium and magnesium, this process for the first time offers a method other than distillation for removing sodium bicarbonate. Naturally, therefore, it has been widely used in the treatment of waters containing sodium alkalinity as well as bicarbonate hardness. Such waters are much more common in occurrence than is generally recognized and, while more prevalent in certain sections, are not confined to any one locality.

Where it is unnecessary to remove the sulphate and chloride content, the usual method of treatment followed is to pass one portion of the raw water through a Zeo-Karb H unit and another portion through a Zeo-Karb Na unit. The sizes of these portions are so adjusted that the sodium bicarbonate content in the Zeo-Karb Na effluent is sufficient to neutralize the content of sulphuric and hydrochloric acids in the Zeo-Karb H effluent. In this way, a completely softened mixed effluent is produced which contains only sodium sulphate and chloride equivalent to the original sulphate and chloride content of the raw water plus whatever amount of bicarbonate alkalinity is desired. Or, expressed in another way, with this process it is possible to soften a water completely and, at the same time, reduce the bicarbonate content to any desired figure.

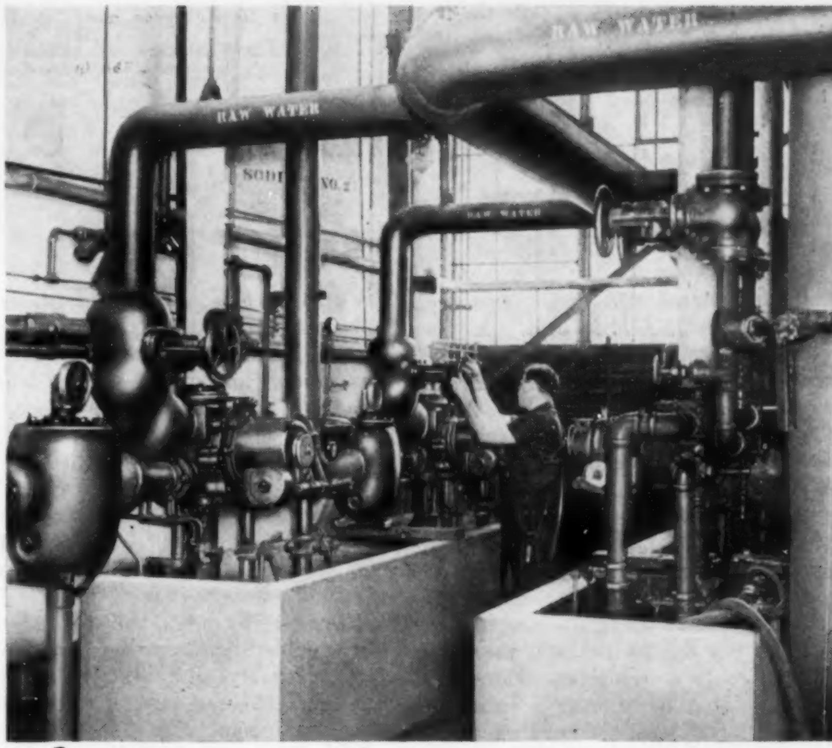


Fig. II—Zeo-Karb H and Zeo-Karb Na units for softening and dealkalizing boiler feedwater in a midwestern utilities plant

ORGANIC ANION EXCHANGERS OR ACID ABSORBENTS

Removal of acids from water may be effected by means of certain synthetic organic materials known as anion exchangers or acid absorbents. The latter term may be the better one as the reaction is probably an absorption of the entire acid molecule. However, the term anion exchanger is more widely used. In any event, they will remove acids from water completely, and can be regenerated, thus renewing their capacity for acid removal.

The earlier anion exchangers, such as m-phenylenediamine - formaldehyde resins and the insoluble basic dyestuffs, were not very successful as their capacities were rather low, they had a tendency to throw color and their life was quite limited. As the result of intensive research work, new products were developed which got away from these undesirable properties. Typical of these new anion exchangers is the aliphatic amine resin, De-Acidite, a granular brown resin which weighs about 40 lb. per cu.ft. when shipped.

When a water containing hydrochloric or sulphuric acid or mixtures of these is passed through a bed of granular De-Acidite, the acids are quantitatively removed. After the useful anion removing properties have been exhausted, the De-Acidite may be regenerated with a solution of soda ash. These cycles of anion removal and regeneration may be repeated for hundreds of cycles with only a small drop in capacity, no color contamination and no rise in the electrolyte content of the effluent. It is still too early to state that the life of these anion exchangers equals that of the resistant sulphonated coal cation exchangers which have been operating day in and day out for years without any apparent drop in capacity, but, to date, commercial installations of anion exchangers have performed satisfactorily.

DEMINERALIZING WATER BY ION EXCHANGE

The demineralizing of water by ion exchange is effected by first passing the water through a bed of Zeo-Karb H and then through a bed of De-Acidite. Any carbon dioxide formed in the first step, goes through the De-Acidite unchanged and may be removed from the effluent by aeration. The units may be either of the pressure type or the gravity type. In the pressure type plant the units are constructed of steel shells lined with acid proof material. Valves, piping and fittings are similarly lined or constructed of corrosion resistant materials.

Raw water flows under pressure through the Zeo-Karb H unit which removes the cations. When the useful cation exchange capacity of the Zeo-Karb H bed is exhausted, the bed is (1) backwashed, (2) regenerated with sulphuric acid from the auxiliary sulphuric acid tank and (3) rinsed until free from calcium, magnesium and sodium sulphates plus the excess sulphuric acid employed.

The effluent from the Zeo-Karb H

Table I—Analyses of Industrially Distilled Water

Plant	Hardness (p.p.m. as $CaCO_3$)	Alkalinity (p.p.m. as $CaCO_3$)	Chlorides (p.p.m. as Cl)	Sulphates (p.p.m. as SO_3)
A	0	13	4	0
B	6	9	0	0
C	10	18	0	0
D	10	15	0	0
E	0	5	2	2
F	0	5	2	3
G	0	4	1	3
H	15	12	2	5
I	1	7	0	1

Table II—Analyses and Cost Data for Industrially Demineralized Water

Plant	Hardness (p.p.m. as $CaCO_3$) raw	Hardness demin.	Alkalinity (p.p.m. as $CaCO_3$) raw	Alkalinity demin.	Chlorides (p.p.m. as Cl) raw	Chlorides demin.	Sulphates (p.p.m. as SO_3) raw	Sulphates demin.	Cost of treatment (cents per 1000 gal.)
J	43	0	34	3	4	0	19	0	3.0
K	61	0	24	2	8	0	26	0	4.9
L	116	0	58	3	2	0	70	0	8.2
M	120	0	93	4	33	0	38	0	9.5
N	212	0	140	6	24	2	80	1	15.3
O	261	0	188	2	10	0	60	0	11.5
P	302	1	227	4	25	0	60	1	16.0

Note: zero, as used, means less than 1 p.p.m.

unit then flows, still under pressure, through the De-Acidite unit. As the water passes through, the mineral acids are taken up and the carbon dioxide goes through unchanged. After the useful acid absorbing capacity of the De-Acidite bed has been exhausted, it is (1) backwashed, (2) regenerated with a solution of soda ash from the auxiliary soda ash tank and (3) rinsed until free from sodium sulphate and sodium chloride plus the excess of soda ash used.

From the De-Acidite unit, the effluent passes to a degasifier. Here, the water raining down over a series of trays is met by a counter-current of air which effectively reduces the carbon dioxide to a very low figure.

With some waters high in sulphates and chlorides and where tolerances for these are low, recycling may be required. Depending on the composition of the raw water and the results required, such recycling may be practiced with only a part of the effluent or with all of the effluent. These processes are known, respectively, as partial or complete recycling processes.

Results obtained are excellent as shown in Table II which gives analyses of the effluents obtained in seven industrial installations.

Silica, however, is not removed by this process and, in those cases where silica removal is of importance, it should be done as a preliminary step before the demineralizing process. For most applications, the silica content of the raw water is low and, except in the treatment of siliceous water for high pressure boilers, silica removal is usually unnecessary.

Removal of mineral salts effected by this demineralizing process compares very favorably with removal by distillation. Theoretically, of course, distilled water should be free from nonvolatile mineral salts. In commercial practice, however, this is not the case as is shown in the analyses of distillates taken at random from nine industrial plants listed in Table I. The reasons for this are probably found in entrainment from the still plus leakage in the condenser, especially after the condenser has been in operation for some time.

OPERATING COSTS

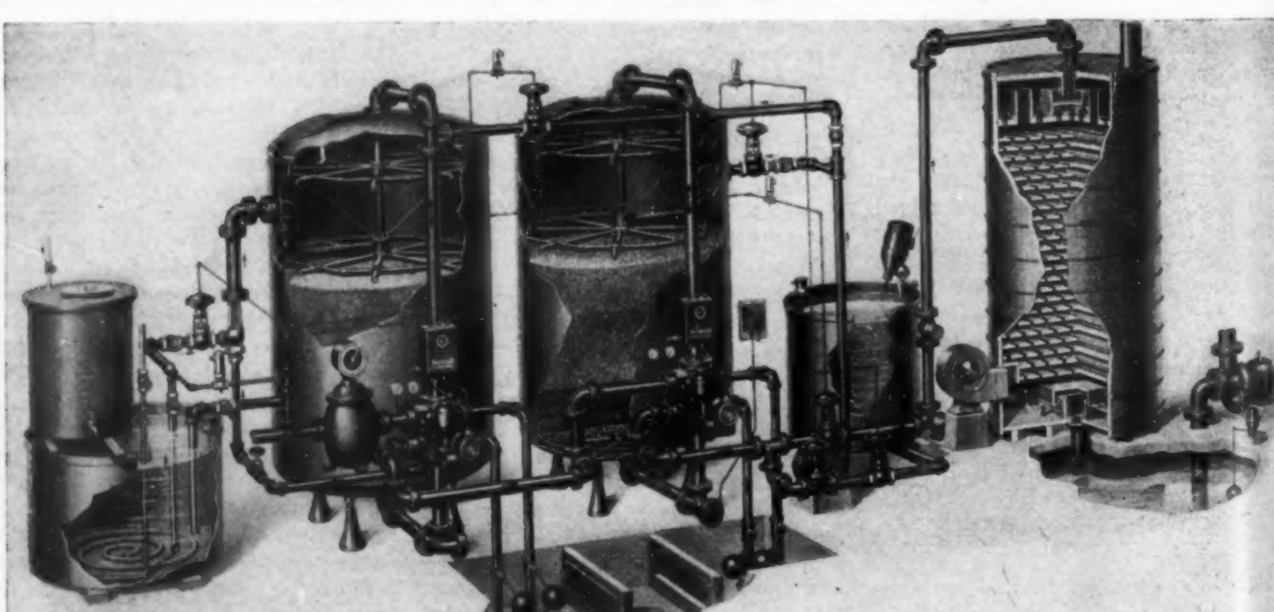
As far as operating costs are concerned, they are principally for the regenerants used. In Table II, the costs of the regenerants for seven installations are given and, since these waters cover a wide range in composition, a good idea of operating costs with various waters may be readily obtained.

It will be noticed that the operating costs for these particular waters range from \$0.03 to \$0.16 per 1,000 gal. Compared with this, distillation costs vary according to the number of effects used and the cost of fuel. In single and double effect stills, or evaporators as they are commonly called, the cost of distillation varies from about \$2.00 to \$8.00 per 1,000 gal. Quadruple effect evaporators, while more complicated to operate and much higher in price, are more efficient and the cost of distillation in them varies from \$0.60 to somewhat over \$1.00 per 1,000 gal.

These figures are comparative in that one gives the cost of reagents while the other gives the cost of fuel. No attempt has been made to include fixed charges as these would be meaningless unless based on waters of the same mineral concentration and against single, double, triple and quadruple effect evaporators.

It will also be noted that the cost

Fig. III—Sectional view of demineralizing plant showing construction of equipment. From left to right are the sulphuric acid tank, Zeo-Carb H unit, De-Acidite unit, alkali tank and degasifier.



of demineralizing varies with the mineral salts content of the raw water. With distillation, this is usually not the case as the cost is not greatly affected by different compositions of the raw water, although highly saline waters, by increasing the amount of blowdown, or hard waters which require softening before distilling, do increase distillation costs.

The accompanying chart, Fig. IV, provides a means by which approximate costs of demineralizing may be calculated. It is based on costs of $40.00 per ton for soda ash and $40.00 per ton for sulphuric acid, which are higher than the costs would be for plants using large quantities of these reagents. It will be noted that the costs are the sum of the results obtained from two curves and that the cost of removing bicarbonates is much lower than the cost of removing sulphates and chlorides. This is because only a single regenerant—sulphuric acid—is required for the former, while two regenerants—sulphuric acid and soda ash—are required for the latter.

Table III—Installations for Demineralizing Water

Company	Application	Date of Installation	Flow Rate (g.p.m.)
A	Mirror silvering	1937	2.5
A-2[a]	Mirror silvering	1941	9–23
B	Cellulose acetate mfg.	1938	100
B-2[a]	Plastics mfg.	1940	10
C	Chemicals mfg.	1938	1
C-2[a]	Chemicals mfg.	1940	8
C-3[a]	Chemicals mfg.	1940	8
D	Drug mfg.	1939	3
E	Drug mfg.	1939	10
E-2[a]	Drug mfg.	1940	10
F	Cosmetics mfg.	1941	10
G	Cellulose derivative mfg.	1941	300
H	Pharmaceuticals	1941	5
I	Synthetic rubber mfg.	1941	55
J	Boiler Feed	1941	4
K	Explosives mfg.	1942	20
L	Cotton linters washing	1942	10
M	Synthetic Rubber	1943	400
M-2[a]	Synthetic Rubber	1943	300
M-3[a]	Synthetic Rubber	1943	200
N	Fine chemicals mfg.	1943	125
O	High Pressure Steam	1943	4
P	Chemical Processing	1943	40
P-2[a]	Chemical Processing	1943	40

[a] Numbers indicate repeat installations for the same company.

SIZES AND USES OF DEMINERALIZING PLANTS

Demineralizing plants are available in a wide range of sizes to meet any industrial requirement. Plants installed and under construction have ranged from as low a flow rate as 1 g.p.m. up to many thousands of g.p.m. Table III shows a partial list of installations of various capacities expressed in gallons per minute, the uses to which the demineralized waters are put and the dates of installations.

Table IV—Products, Processes and Industries in which Ion-exchangers May Be Useful

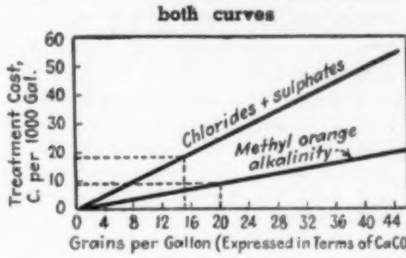
Alkaloids	Insecticides
Beverages	Milk products
Biologicals	Minerals and earths
Canned juices	Non-ferrous metals
Chemicals, water soluble	Oils, vegetable and animal
Chemicals, others	Paints, pigments and varnishes
Catalysts	Petroleum products
Coke oven products	Precious metals
Corn syrup	Radium
Corn products	Soap and glycerine
Drugs	Sugars
Electroplating	Vinegar and cider
Flavoring extracts, etc.	Vitamins
Foods	Wine
Glue and gelatin	Wood distillation
Hydroponics	

ION EXCHANGE IN PROCESS INDUSTRIES

As mentioned in the introduction to this article, cation and anion exchangers used in demineralizing water are finding uses in other fields. Table IV lists some of the products and processes in which ion-exchangers may be useful.

In addition to these, there are a number of other process industries in which ion exchangers should be tried. The possible applications in this group of industries have to do with purification of product or waste treatment. For example: Adhesives, China and fireclay, dyestuffs, dyeing and finishing, fish processing, industrial alcohol, leather, liquors, malt and distilled, meat packing by-products, pulp and paper, rayon, rosin, silk degumming and woolen scouring. Without doubt, the postwar period will see further rapid development of ion exchange reactions in the chemical process industries.

Fig. IV — Variation of regeneration costs with composition of raw water. Cost is the sum of results obtained from both curves



MAGNESIUM

(*Continued from page* 101)

ing the pouring. Tilting of the frame is synchronized with movement of the mold chain so that each mold is filled with exactly the right amount of metal. One side of each mold is built up in a V shape which overlaps the low side of the neighboring mold, so that no metal is spilled as the chain advances. Movement of both furnace and chain is entirely smooth at all times, and the choking atmosphere of SO_2 which surrounds the hand operation is absent. A reducing atmosphere does surround the molten metal until it solidifies, but no fumes escape into the room.

Care is taken to prevent pouring out of the pot any of the sludge which has settled to the bottom, and when all possible pure metal has been poured out, the tilting furnace is returned to an upright position and the pot removed. The empty pot is transferred to the cleaning room nearby and a fresh pot is immediately placed in the casting machine. Two overhead cranes serve the refining room, and so rapidly do they carry the 2-ton pots on the round from furnace to casting machine to clean-up and back to furnace that there is never a break in the procession of trucks leaving the refining room loaded with magnesium. Even when an empty pot is exchanged for a full one at one of the casting machines, there is only a short pause in the steady clinking of ingots dropping from the end of the mold chain.

In the cleaning room, the pots are entirely emptied of sludge, and as much metal as possible is recovered. After a rapid inspection and cleaning, the pots are swung out again and put back into the nearest empty furnace to be refilled.

Adjoining the refining room, is storage space for ingots awaiting sampling, inspection, and weighing. Beyond the stacked ingots are assembly-line arrangements run by women, in which approved ingots are wrapped for shipment. This bare statement of fact does these women an injustice, however, for they work with a sort of desperate urgency unmatched anywhere else in the plant.

One could easily, and perhaps someone will, fill a book with the whole story of this enterprise. Aside from building the main plant, the erection of the workers' townsite, complete with air-conditioned houses, schools, and stores is a major achievement, as is the construction of the power lines and pipe lines into the plant. Every existing type of engineering skill and experience had a part in this project, and is working right now to expand its production even beyond the incredible limits set originally. As to the future of this young giant, your guess is as good as anyone's, but its present and its past are written large across a square mile of Nevada desert and hundreds of square miles of Axis sky. BMI's men don't worry about tomorrow just yet; they are too busy turning out the magnesium we need today.

PLANT NOTEBOOK

HERE'S YOUR CHANCE FOR ANOTHER WAR BOND!

For the best short article received during each of the three months of November and December 1943, and January 1944, and accepted for publication in *Chem. & Met.'s* "Plant Notebook," a $25 Series E War Bond will be awarded, in addition to payment at our usual space rate for this department. To be eligible for one of the three awards an article must be received during one of the three months mentioned. The award for each month will be announced in the issue for the following month. The judges will be the editors of *Chem. & Met.* and it is a condition of the contest that any item submitted may be published in this department, but that all items so published will be paid for at our usual rate for such material.

The contest is open to all readers of *Chem. & Met.*, other than employees of the McGraw-Hill Publishing Co., Inc. Any number of entries, without limit, may be submitted by one person. Articles must be previously unpublished, and should be short, preferably less than 300 words, but should include one or more illustrations if possible. Finished drawings are not required and literary excellence will not be a factor in the judging. Winning articles will be selected on the basis of appropriateness, novelty and usefulness of the ideas described.

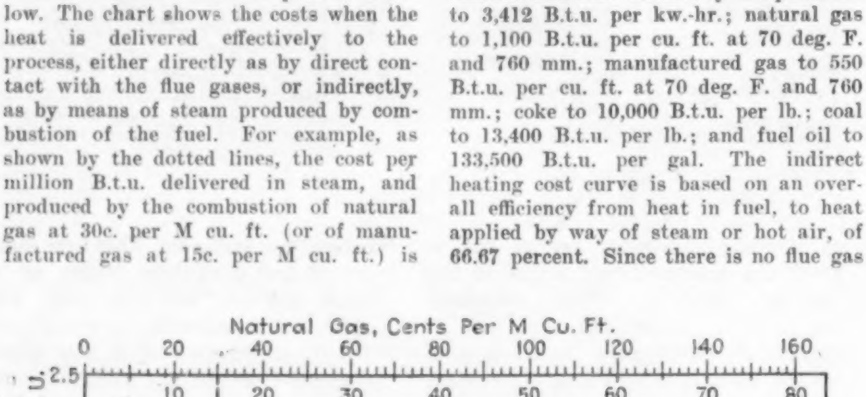
Articles may deal with any sort of plant or production "kink" or short-cut which in the opinion of the judges will be interesting to chemical engineers in process industries, as well as with cost reducing ideas, and novel means of presenting useful data. Material to be entered in this contest should be addressed to Plant Notebook Editor, *Chem. & Met.*, 330 West 42nd St., New York, 18, N. Y.

COMPARATIVE FUEL COSTS SHOWN BY NEW CHART

WILLIAM J. SHORE
Engineering Consultant, New York

READY COMPARISON of the costs of various fuels can be made by means of a new chart which is presented below. The chart shows the costs when the heat is delivered effectively to the process, either directly as by direct contact with the flue gases, or indirectly, as by means of steam produced by combustion of the fuel. For example, as shown by the dotted lines, the cost per million B.t.u. delivered in steam, and produced by the combustion of natural gas at 30c. per M cu. ft. (or of manufactured gas at 15c. per M cu. ft.) is 40.5c., while the cost per million B.t.u. in direct heat, produced by the burning of coke at $10 per ton, is 50c.

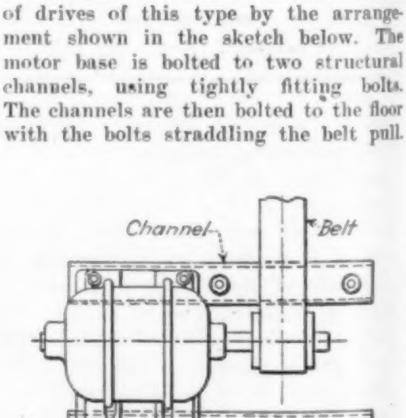
The chart is based on the following calorific values and efficiency factors: For the direct heating cost curve it is assumed that heating is 100 percent efficient and that electricity is equivalent to 3,412 B.t.u. per kw.-hr.; natural gas to 1,100 B.t.u. per cu. ft. at 70 deg. F. and 760 mm.; manufactured gas to 550 B.t.u. per cu. ft. at 70 deg. F. and 760 mm.; coke to 10,000 B.t.u. per lb.; coal to 13,400 B.t.u. per lb.; and fuel oil to 133,500 B.t.u. per gal. The indirect heating cost curve is based on an overall efficiency from heat in fuel, to heat applied by way of steam or hot air, of 66.67 percent. Since there is no flue gas loss with electric heat, it is assumed that the cost for indirect electric heat is the same as for direct.



BOLTING-DOWN ARRANGEMENT FOR MOTOR BASES

CHESMAN A. LEE
Engineer, Evanston, Ill.

IN A PLANT having wood floors, such as the one where the writer is employed, it is a common experience to find motor drives pulling out of line when they are bolted to the floor. This is caused by "give" either in the floor or in the bolts, and its solution is to eliminate eccentricity in the application of the load. The writer cured a number of drives of this type by the arrangement shown in the sketch below. The motor base is bolted to two structural channels, using tightly fitting bolts. The channels are then bolted to the floor with the bolts straddling the belt pull.



CHEM & MET REPORT ON . . .

Bulk Packaging of Chemicals

Wartime Trends, Postwar Possibilities

From metal to wood to paper: this has been, briefly, the wartime story of materials for bulk packaging of chemicals. Metal containers soon became so critical that whenever at all possible, raw materials and products have been forced to alternate packages. Soon, however, glass and then tight cooperage and fiberboard drums followed metal containers into the scarce list. Paper, on the other hand, has remained relatively plentiful, as a result of which the heavy-duty multiwall paper sack is threatening to become the tonnage king of chemical containers. This increasing use of paper was at first necessary, but the fundamental advantages and economies of the versatile multiwall paper bag for many solid products has accelerated a trend that may very well become highly important in postwar packaging. Such a situation is made more likely because of the studies and improvements now being made on the suitability of this package for specified chemicals. Even though other types of containers are still vitally important and will regain much of their volume use after the emergency, the shift to paper is the one basic trend in bulk packaging of chemicals that has resulted from the war. For this reason, a large part of this report has been devoted to the present and postwar possibilities of the multiwall paper bag as a tailor-made container for chemicals. Other types of containers are, therefore, discussed only briefly.

NORMAL packaging requirements for chemical products and raw materials run the gamut of the entire containers line-up: paper and textile bags; fiber and wooden drums, barrels, kegs and boxes; carboys and other glass containers; blackplate, tinplate, and terneplate cans; metal drums of all sorts; low-pressure and high-pressure gas cylinders; box cars and barges, tank cars and tankers. Variety of the products packaged is shown by the fact that one chemical concern, with an unusually large number of different items, had a prewar list of some 8,000 different packages in sizes ranging from 0.5 mg. to a tank car.

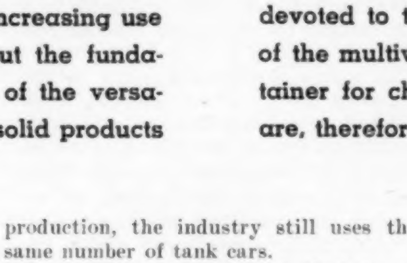
Thus, it was only natural that the demands of all-out war would quickly bring about shortages of packaging materials and dislocations of the usual packaging procedures. Luckily for the industry, the problems of wartime container substitutes and alternates have been met aggressively by a staff of trained packaging engineers, both in the chemical and the container industries.

TANK CARS

There are not enough tank cars available to meet present shipping needs and no more can be built for the duration. When the war started, the chemical and allied industries were using about 14,000 tank cars. Today, despite the ever-increasing demand for chemicals in war production, the industry still uses the same number of tank cars.

Hundreds of carloads of alcohol are moving from plants which formerly made whiskey to new synthetic rubber plants; other cars are carrying methanol to producers of explosives and essential plastics; several hundred more are carrying benzol for aviation gasoline; sulphuric acid for steel and other war materials requires some 3,000-4,000 tank cars; molasses for alcohol and glycerol moves by tank car when water transportation is not available. Not only war materials but the nation's food production requires thousands of tank carloads of chemical solutions for fertilizers and soil enrichment materials.

A four-month backlog of unfilled orders: that's the story on heavy steel drums shown by this chart



Several temporary emergency changes have been issued by the Interstate Commerce Commission to help relieve this tight situation regarding tank cars and tank-car shipping of chemicals. For instance, in December of last year, emergency tank cars formerly authorized for transporting gasoline were permitted to be used for certain chemical liquids weighing not more than 8 lb. per gal. and with vapor pressures not over 16 lb. per sq.in. absolute at 100 deg. F.

Since the synthetic rubber and chemical warfare programs require large volumes of alcohol, tank cars complying with certain specifications and formerly used for transporting wines were authorized in early 1943 for use in alcohol service if equipped with safety valves of the proper type. Another directive issued by ODT this August requires loading in the dome of certain tank cars, thus increasing the capacity 3-5 barrels. For products such as gasoline, which cannot be loaded in the dome safely, other standards are provided. Heavy fuel and gas oil, furnace oil, vegetable oils and some chemicals can be dome-loaded without excessive danger.

METAL DRUMS

Steel drums, prewar backbone of chemical packaging, began to show signs of

Production of Heavy Steel Barrels and Drums[1]

	July, 1943	Total, Seven Months 1943	1942	1941
Production, total	2,273,611	13,735,709	13,569,086	9,785,260
Heavier than 16 gage, all capacities	8,439			
16 gage, 55 gal. capacity	1,053,002	13,735,709	13,569,086	9,785,260
18 gage, 55 gal. capacity	1,091,733			
All other heavy types, all capacities [2]	120,437			
Shipments, total	2,273,790	13,750,920	13,565,284	9,789,926
Heavier than 16 gage, all capacities	8,587			
16 gage, 55 gal. capacity	1,049,563	13,750,920	13,565,284	9,789,926
18 gage, 55 gal. capacity	1,097,670			
All other heavy types, all capacities [2]	117,970			
Stocks at end of month	50,780	....	....	....
Unfilled orders, end of month	8,763,705	....	....	....
Delivery period 30 days or less	2,232,602	....	....	....
Delivery period more than 30 days	6,531,103	....	....	....

[1] Steel barrels and drums (except beer barrels) of 19-gage or heavier steel, and steel barrels and drums made wholly or partly of 20-gage, when of other than open-head construction; also grease drums of 100-lbs. capacity when made of 20-gage or heavier steel. Data from Bureau of Census, U. S. Dept. of Commerce.
[2] Includes a small number of units of 20-gage body with 18-gage heads, 55-gal. capacity.

becoming tight by the fall of 1941. However, the Container Standardization Committee of the Manufacturing Chemists' Association was early successful in getting the industry to standardize on 5-gal. and 55-gal. single-trip steel drums for liquids and on 55-gal. returnable drums, with the exception of 110-gal. drums for aqua ammonia and 20-gal. drums for hydrofluoric acid. This committee also pioneered development of fiber drums to replace steel.

Early in 1942, the Containers Branch of WPB was organized and began consulting with drum fabricators. As a result, an advisory committee of steel drum manufacturers was organized. By May, 1942, the situation was becoming increasingly difficult and the Chemical Division of WPB appointed a containers section to help chemical companies solve their container problems.

Since that time a number of measures and substitutions have been adopted which, though not eliminating the basic shortages, have certainly "saved the day" in respect to metal containers for chemical use. However, necessity of conserving steel drums is still one of the most serious problems confronting the chemical industry. Neither new nor used drums can be purchased for many products and a very critical situation is now developing in steel shipping drums.

Prewar steel containers were usually fabricated from continuous hot mill sheets and cold reduced sheets, but by early 1942 users were glad to have drums fabricated from hand mill sheets. More recently Bessemer steel, annealed to eliminate excessive stiffness, has been used, especially for light-gage drums. Most popular type of the single-trip containers for liquids has been the 55-gal., 18-gage tight head drum with two small openings. For heavy liquids and pastes, open-head drums have been most commonly used. Light-gage drums for dry materials, fabricated of 18-gage to 30-gage steel with openings varying from small friction covers to full open heads, have already been replaced to a large extent by other less critical containers.

One major change was made in the spring of 1942, when chemical companies changed their sales arrangements to maintain title to the light-gage drums formerly sold with their products. These single-trip drums, now serving as returnable containers, are not constructed for returnable service, and their life expectancy is necessarily short. Such drums should not be returned empty over long distances. Instead, shipment of empties from the East to the West Coast, for instance, should be traded to a West Coast chemical producer, and those shipped from the West to the East might be given to the eastern shipper.

LIMITATION ORDERS

Limitations placed during the fall of 1942 required that priorities be obtained before purchasing steel drums for transporting any product not prohibited. Furthermore, this rating must be referred to the Containers Division for final permission to buy the drums.

This order, which restricted use of steel drums for materials for which no substitute packages had been found, was revised in early 1943 to prohibit use of steel drums for packing a total of 175 products or classes of products. However, at the same time it (1) removed all restrictions on packing in steel drums certain acetates, alcohols, phthalate esters, chlorates and thin penetrating liquids; (2) exempted from restrictions drums heavier than 14 gage and used drums lighter than 23 gage and larger than 25-gal. capacity; (3) prohibited use of steel drums for a number of chemicals, including ammonia and potash alum, sodium aluminate and ammonium nitrate.

Another amendment has just recently freed the use of second-hand steel drums and lifted restrictions on use of steel drums for certain chemicals such as solid arsenic acid and arsenic trioxide, calcium, sodium and lead arsenates, bottle-washing compounds, cements, chloride of lime, dry cleaning compounds, organic colors, dry dyestuffs, dry lime sulphur, metal degreasing alkalies, molding powder, sodium and zinc hydrosulphites.

New restrictions on used drums prohibit the use of empty drums for purposes other than packing edible products if capable of being reused for the same purpose and previously used therefor. The same restrictions also apply to the sale or delivery of empties previously used for packing naval stores products.

In order to help, the Interstate Commerce Commission has empowered the Bureau of Explosives to grant permission to shippers to re-use single-trip containers for transportation of certain dangerous articles provided the shipper agrees to test the drums before each reshipment.

Because of the shortage of steel and the over-taxed cylinder fabricating capacity, it has become very urgent that cylinders for liquefied gases also be kept in circulation and turned over rapidly, and that purchases be made as often as practical. What can be done along these lines is illustrated by the fact that three years ago one manufacturer averaged two turnovers a year on acetylene cylinders; he is now averaging nine. Another averaged four turnovers a year on oxygen cylinders, but is now averaging 24. There is, of course, little or no hope of a more plentiful supply of cylinders in the near future.

GLASS CARBOYS

Demand for carboys had become so great by early 1942 that facilities of glass bottle manufacturers were severely taxed. However, plant facilities were then expanded and the supply of bottles to the chemical industry increased. This shortage was primarily due to the fact that a number of liquid products which could no longer be packed in steel containers were being transported in carboys. It is likely that the heavy demand for carboys will continue until the steel drum situation becomes improved.

It was early evident that standardiza-

Production of Light Steel Barrels and Drums[1]

	July, 1943	Total, Seven Months 1943	1942	1941
Production, total	394,175	1,967,829	3,364,147	2,085,776
Welded side seam construction	87,995	365,495	879,265	631,893
Lock side seam construction	306,180	1,602,334	2,484,882	1,453,883
Shipments, total	392,875	2,016,546	3,425,733	2,086,899
Welded side seam construction	87,659	428,994	934,570	631,286
Lock side seam construction	305,216	1,587,552	2,491,163	1,455,613
Stocks at end of month	43,206	....	....	....
Welded side seam construction	14,674	....	....	....
Lock side seam construction	28,532	....	....	....
Unfilled orders, end of month	1,565,047	....	....	....
Delivery period 30 days or less	372,412	....	....	....
Delivery period more than 30 days	1,192,635	....	....	....

[1] Steel barrels and drums (except beer barrels) of steel lighter than 20-gage, including those partly or wholly of 20-gage if of open-head construction; also grease drums of 100 pounds capacity if steel is lighter than 20-gage. Data from Bureau of Census, U. S. Dept. of Commerce.

Metal Drums for Overseas Shipments of Dry or Solid Materials

Marked Capacity, gal.	Authorized Gross Weight, lb.	Minimum Thickness: Body Sheet (Gage U. S. Std.)	Minimum Thickness: Head Sheet (Gage U. S. Std.)
3 to 55....	80	24	24
3 to 55....	160	22	22
3 to 55....	300	20	20
3 to 55....	425	19	19
3 to 55....	480	19	19
3 to 55....	880[1]	18	18
3 to 55....	1,280[1]	16	16

[1] Chime reinforcement required.

tion of glass containers would be necessary, and accordingly a limitation order, issued in April, 1942, provided for approximately 90 standard glass containers for food products alone, a reduction of several thousand designs. As a result of this standardization, about 860 million more glass containers (20 percent more than in 1941) can now be made on existing fabricating equipment.

The situation continued to grow tighter, however, and the glass container manufacturers' industry advisory committee in July of this year recommended strict temporary control over use of new glass containers by certain industries, since demand for these containers now exceeds the ability of the industry to produce by approximately 20 percent. However, since all 12-gal., 13-gal., and some of the 42-pint carboy bottles are hand-blown, it is not likely that restrictions as to use will apply to these.

WOODEN BARRELS

As a result of efforts to find alternates for steel containers, the wooden barrel has staged a comeback in the packaging of chemicals, although a 50-gal. tight wooden barrel weighs about 72 lb. as compared to 51 lb. for a 55-gal., 18-gage steel drum. The wooden barrel also requires greater shipping space. In World War I, probably 95 percent of all petroleum products shipped was packaged in wooden barrels.

Tight cooperage is suitable for packing certain chemicals, although care must be given to the selection of wood, lest the chemicals be damaged. Anhydrous organic chemicals are usually unsuited for such containers since they tend to extract moisture from the wood and spoil both product and container. Thin, penetrating liquids may also be unsuitable especially if shipped long distances through very hot regions such as exist in the West, since under these conditions some seepage may occur. The possibility of packing vat dyes in tight barrels is now being considered. I.C.C. regulations of late 1942 permitted the use of tight wooden whiskey barrels complying with certain specifications for use with flammable liquids flashing between 20-30 deg. F.

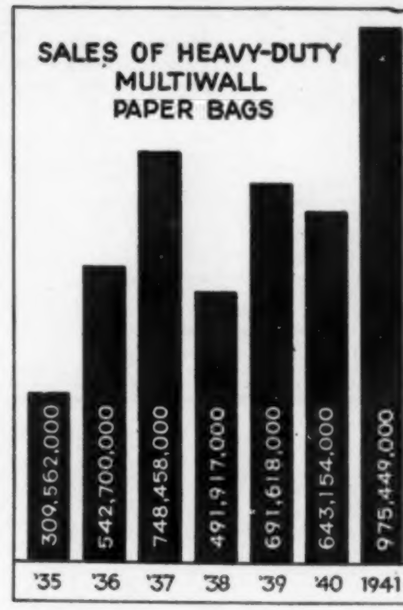
During 1942, the domestic tight cooperage industry produced some 8,000,000 barrels and 6,000,000 kegs, but the present supply of tight wooden containers is almost as "tight" as that for steel drums. This is caused to a large extent by a labor shortage that goes back to the tree-cutting operation.

Though the structure of the modern slack wooden barrel remains essentially the same, recent important improvements have taken place in the use of linings and coatings that make these containers more adaptable in the bulk packaging of chemical products. Another improvement consists of a weatherproof coating with an asphalt base, which is claimed to withstand heat, cold, dryness and moisture without causing swelling or shrinking of the wood.

Demands for slack barrels by the chemical industry have not decreased appreciably, since the increased use of barrels for packing dairy alkalis and similar chemicals has offset the decrease due to the recent removal of bicarbonate of soda and soda ash from the list of products permitted to be shipped in these barrels.

Slack barrels were also approved in early 1943 for carrying not over 350 lb. net weight of sodium sulphide. However, for this use a lining is required which must be heavy waxed duplex (asphalt laminated) kraft paper having 90 lb. basic weight and at least 90 lb. Mullen test.

Regardless of the actual situation, the cooperage industry has been called upon by WPB to supply some 18,750,000 wooden barrels and kegs to pack foods, chemicals and other essential products during the fourth quarter of 1943 alone.



TEXTILE BAGS

Dwindling supplies of imported jute for burlap during the early part of the Asiatic phase of the war resulted in broadened uses of cotton bags for bulk packaging. To meet this demand for cotton bagging fabrics, weavers and finishers have introduced a number of innovations. As a result, cotton bags with grease-proof liners are now carrying pigments, putty and sweeping compounds, and cotton combined with one or more plies of paper and moisture-resistant

Handling one of the 170 chemical products now being packaged in multiwall paper sacks. Half of the 300 products shipped in these bags represent new uses

Metal Drums for Overseas Shipment of Certain Types of Liquids[1]

Marked Capacity, gal.	Minimum Thickness: Body Sheet (Gage, U. S. Std.)	Minimum Thickness: Head Sheet (Gage U. S. Std.)
Up to 5..........	24	24
Over 5 to 10......	24	22
Over 10 to 33.....	18	18
Over 33 to 55.....	16	16

[1] "Army-Navy General Specification for Packaging and Packing for Overseas Shipment," Feb. 15, 1943.

Outer Containers Suitable for Overseas Shipment of Certain War Supplies[1]

Class of Article	Cleated Plywood Box	Nailed Wood Box	Wirebound Box	Fiber Box [2]	Tight Barrel	Metal Drum	Fiber Drum	Plywood Drum	Textile and Multiwall Bags
Paper	x	x	x	x	—	—	—	—	—
Textiles	x	x	x	x	—	—	—	—	x
Liquids in bulk	—	—	—	—	x	x	—	—	—
Liquids in containers	x	x	x	x	—	—	—	—	—
Fluxes and compounds	x	x	x	x	x	x	x	x	x
Drugs and chemicals in bottles	x	x	x	x	—	—	—	—	—
Chemicals: inert, powdered or granular in bulk	—	—	—	—	x	x	x	x	x
Chemicals: inert, powdered or granular in containers	x	x	x	x	—	—	—	—	—

[1] "Army-Navy General Specification for Packaging and Packing for Overseas Shipment," Feb. 15, 1943.
[2] Maximum weight of box and contents, 70 lbs. for solid fiber box. This table does not cover items governed by I.C.C. regulations on transportation of explosive and other dangerous articles.

adhesives have been adapted for the bag packaging of cement, various chemicals, powdered soaps and salts.

However, the inevitable shortages of cotton cloth and burlap led to a conservation order in the spring of 1943 which curtailed the sale of new burlap bags and restricted their use to chemicals (other than fertilizer) and certain specified animal and human foods.

Products that could be packed in new burlap bags were increased under the terms of a recent amendment, thus reflecting some improvement in the supply of burlap and the availability of heavy-weight burlap. Hithertofore only light-weight burlap has been available for bag making. Under the amendment, petroleum waxes, stearic acid (either cakes or slabs) and salt are permitted, for the first time, to be packed in new burlap bags. However, a time limit was imposed on the holding of empty bags by emptiers. Within sixty days after emptying textile bags a commercial emptier must use or transfer to dealers or users an equal number of empties from his inventory.

There are more than 500 different kinds of cotton bags reported to be used for packaging purposes, ranging in size up to 200-lb. containers for sugar. By the spring of this year it looked as if more than twice as many cotton bags will be used in 1943 as during 1940. Some of the new and expanded uses that improved textile bags have captured from other containers will conceivably be retained in the postwar packaging set-up, although competition between various types of bags, barrels and drums will no doubt be keen.

Compactness is a major advantage of multiwall paper bags since 100 empty units, with a capacity of five tons, require less than 3 cu. ft. storage space

FIBER DRUMS

Fiber drums are being used on an increasing scale for packing materials in bulk, such as dry chemicals, molding powders, rubber accelerators, pharmaceuticals, cleaning powders, insecticides, c.p. chemicals, synthetic resins, greases and other non-liquid materials which commonly move in metal drums or barrels.

War materials such as D.N.T., guanidine nitrate and smokeless powder are being packaged in fiber containers. These have also recently been adapted to package materials like calcium and sodium cyanides and sodium hydrosulphite which, when exposed to moisture, can give off poisonous gases. For the packaging of the more active chemicals, a chemically resistant, waterproof and moisture-vapor resistant laminant has been developed. Fiber drums have been made moisture-proof by the use of an asphalt compound as a laminant and a resinous varnish (phenolic and urea) on the outside of the drum for weather-proofing.

Manufacturers of fiber drums were successful in taking care of the heavy demand for these containers until the Government made it mandatory to substitute non-metallic containers for specified products. This increased the demand beyond the manufacturing capacity of the industry and requirements steadily increased until priority ratings based on the type of products packed were assigned in June, 1943. Consequently, by the spring of this year there were not enough fiber drums available to pack the fine chemical products for which these containers were originally designed. These materials, including molding powders, resins, rubber chemicals and pharmaceuticals, were assigned an AA-3 rating. To make matters worse, the industry is now experiencing a critical shortage of paperboard, adhesives and skilled help at a time when demand for fiber drums is far in excess of the supply. Of the total demand for fiber drums, approximately 60 percent usually is from the chemical industry, including paint; 20 per cent for petroleum products; 7 percent for foods; and 13 percent for other products, such as shoe finishes, inks and abrasives.

In December 1942, the 21A fiber drum, holding a maximum net weight of 250 lb., was added to the list of approved containers for fused, chipped or broken sodium and potassium sulphides. These drums must contain moisture-proof liners or have one added ply of asphalt-laminated kraft in sidewalls and heading. An amendment was made in February of this year to allow cyanides and cyanide mixtures to be shipped in these drums, which must be lined or coated or otherwise treated so as to prevent the entrance of moisture in quantities sufficient to create a hazardous condition.

Interstate Commerce Commission emergency changes in regulations, designed to help relieve the metal drum situation, now permit black powder and low explosives to be shipped in fiber kegs provided the net weight is not over 25 lb. In addition, Specification 21A fiber drums have been added to the approved list of containers for smokeless powder. Paints (other than aluminum, bronze and gold paint) enamel, varnish, shellac and lacquer, with flash point above 20 deg. F., may be shipped in fiber drums conforming to Specification 21B.

Most manufacturers of convolutely-wound drums with fiber, wood and steel heads have made changes in their containers to adapt these to hold greases, paints, pastes and similar products. This has been accomplished by development of impervious linings, use of new adhesives, addition of coated or laminated plies, or of combinations thereof. Treatments to withstand heat and prevent material from sticking to the paper wall have increased the acceptability of these containers for packing hot liquids, even up to 400 deg. F., which solidify when they cool. Such molten-packed solids include large amounts of synthetic resins, asphalt, waxes and refined rosin.

No plain fiber drum offers 100 percent protection against the entry of moisture. It is interesting to note that with waxed paper, from 0.1 to 120 gm. of water can pass through 1 sq. meter of the material in 24 hr. when the differential pressure is 1 mm. of mercury, the amount varying according to the precise quality of the "waxing." For ordinary paper the figures are 70-250; vegetable parchment, 25-70; cellulose acetate, 0.1-150; cellulose nitrate, 1.4-15. These figures were determined by the National Bureau of Standards.

Efforts to pack such dehydrating agents as silica gel, for instance, in moisture-proof fiber drums have not been successful, according to engineers of the Davison Chemical Corp. This product is capable of absorbing 50 per-

nt of its weight in moisture and yet ust be delivered ready for use for acking vital machinery and metal parts ith not more than 5.5 percent moisture. ll handling, packing and shipping of ch a product must obviously be done a manner to preclude all moisture. n fact, packaging is done at a temperature of about 400 deg. F. in a room with) percent or less relative humidity. onsequently, Davison researchers find hat this concern's silica gel can be ackaged satisfactorily only in sealed teel and glass containers, since in practice ordinary moisture-vapor barriers are ot efficient enough to maintain an atmosphere less than 20-30 percent relative humidity for any considerable period of ime.

Magnitude of the possible savings in etal containers is illustrated by the ase of one large chemical manufacturer who reduced purchases of metal containers from 77 percent of his annual container requirements to 13 percent by the aximum use of fiber drums and wooden arrels. At present, about 55 percent of his country's total paper production is oing into containers for shipping chemicals and other vital war products.

MULTIWALL BAGS

robably most important and least ical of all the containers being used . an increasing scale to relieve the rtage of metal, wooden and burlap ainers is the heavy-duty multiwall r bag. Single-wall containers were t the only kind of heavy-duty paper used before World War I, at which supplies of hemp and salvage rope came scarce and bag makers began experimenting with kraft. Soon the advantages of more plies were apparent, ut until about 1925 all these bags had sted satchel bottoms. Then a method sewing the ends was discovered which ade it possible to combine a number of heets, the real beginning of the modern ultiwall paper bag.

By about 1937 the greater part of the cement and virtually all hydrated lime and gypsum plaster were packed in this type of bag, cement alone using probably close to 70 percent of the total multiwall bag production. In 1936, more than 120 million of these bags were produced o package some 16 million tons of various materials. Within the last few years applications of these bags have expanded enormously, and over a billion such bags were used in 1942 for packaging more than 300 different commodities, including some 150 or more chemical products.

Popularity of the multiwall paper bag, other than as an emergency substitute container, is due to its rugged construction, ability to protect against moisture, flexibility to allow special designing, and adaptability to packaging a wide variety of products. Special sheets, as required, are used to make the bags resistant to chemical action, moisture-vapor penetration, and contamination. The paper shipping sack industry advisory committee and WPB officials have done an excellent job of studying possibilities for expanding the use of paper shipping bags as a less-critical container for various chemicals. The Chemicals Division of WPB has established "task groups" representing the bag and chemical industries, and these groups are now considering technical problems relating to use of bags for shipping a large number of individual chemicals.

Multiwall bag types being used today include those designed: (1) to resist moisture-vapor penetration for packaging hygroscopic and deliquescent products, such as calcium chloride and quicklime; (2) to resist oil penetration; (3) to prevent penetration of hot liquids when packed and to facilitate removal of the paper from the solidified material, such as asphalt, hot wax and resin; (4) to resist chemical action of the contents, such as superphosphate and mixed chemical fertilizers; (5) to package wet or moist products; (6) to prevent sifting of finely ground or poisonous products, such as carbon black and insecticides; (7) to act as shipping containers for smaller packages, such as 2-, 5- and 10-lb. sugar bags; (8) to resist abrasion and scuffing from the contents, such as frit, or from rough handling such as in export; (9) to resist the elements, as well as rot and mildew, especially in tropical climates.

Multiwall bags are usually in 25- to 100-lb. capacity, made up of several layers of heavy kraft paper assembled in tube form so that each layer bears part of the load and adds to the strength of the whole. Modern multiwall bags are usually made with 3-6 walls of kraft paper, depending upon the weight, density and physical characteristics of the products they are intended to carry. There is a possibility that as many as eight plies may be used in the future. Greater flexibility and strength and lower costs are obtained by using several walls and relatively high basis weights, rather than one wall of heavy paper.

Since the walls of the multiwall paper bag are relatively movable, the container is pliable and flexible, thus giving the strength required to stand up under the strain of modern transportation. Best results are usually obtained by using sheets of 40-50 and 60-lb. in basis weight, although the upper limit for certain purposes may be safely extended to 70 lb. Basis weight of kraft paper is measured in terms of the weight of 500 sheets cut 24 in. x 36 in.

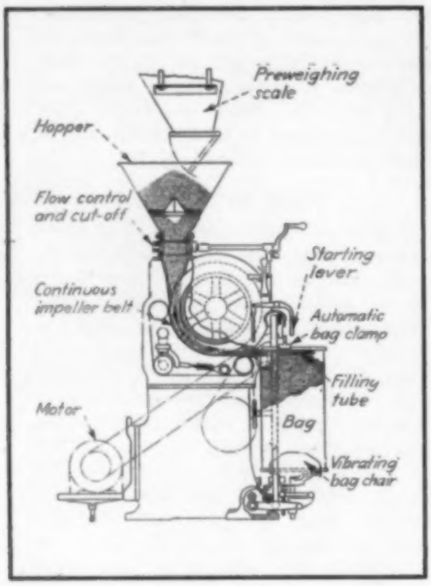
TYPES OF PLIES

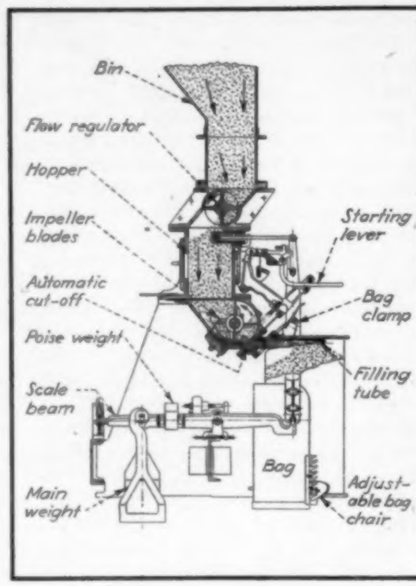
Of the special types of plies most commonly used, two light-weight kraft papers laminated with a continuous film of asphalt give high water and moisture-resistant qualities at relatively low cost. High-sized and moderately high-finished papers are used as outside walls, particularly on fertilizer bags, to withstand rain well. Other high finishes make the paper slightly slippery so that dust will not adhere to the surface, and special coated sheets have been designed to resist high temperatures. Tub-size sheets are made for outside walls for application when scuffing is apt to cause heavy breakage.

Wet-strength sheets are specially treated to give higher tensile strength, scuff and abrasion resistance when wet. Crepe kraft is used in the tape of sewn-end bags and for tuck-in sleeve valves, and in some instances it also has advantages as one or more plies in the body of the bag. Wax papers, treated with both paraffin and microcrystalline waxes, are used to give moisture resistance, but should only be used within limits recommended.

Glassine laminated to glassine or to kraft paper is sometimes used as an inner liner to resist penetration of oils and greases that might ordinarily be absorbed by natural kraft and similar papers. This has high moisture-proof qualities but very hygroscopic material, such as calcium chloride, will dehydrate the glassine and cause it to shrink and become brittle. Cellophane, pliofilm, metal foil and parchment are at times used for special protective purposes and are usually laminated to one of the plies.

Filling asphalt into paper bags at the Lunday-Tagart Oil Co. in Southgate, Calif. The asphalt is packed at a temperature of 290-310 deg. F., using a 50-ft. boom equipped with a valve and filling pipe about every 3 feet of its length





Two of the four basic types of multiwall valve paper bag packing machines: (left) belt type, and (right) impeller type

Adhesives used between the plies are mostly of vegetable origin, although animal glues are occasionally used. Latex, before the war, was one of the best waterproof adhesives for this purpose. Reclaimed rubber glue has proved a satisfactory replacement for latex.

CLOSURES

Multiwall paper valve bags are "factory closed." The tops and bottoms are closed either by sewing or by pasting, and one small opening or valve is left in a corner to admit the material. This valve closes automatically and instantly from internal pressure of the contents as soon as the bag is filled and dumped on the floor. To insure against moisture penetration and sifting, the valve of the multiwall paper bag may be equipped with a "tuck-in" sleeve. Popularity of the valve type bag is shown by the fact that in 1941 some 372 million were sold by the paper bag industry for packaging 60 different chemicals and other commodities.

Open mouth bags are factory-closed only at one end, the other end being closed after the bag is filled, either by sewing, wire tieing, stapling or by the use of gummed tape.

The sewn top closure is an efficient and economical method for closing paper bags and can be accomplished automatically with the use of equipment especially designed for this purpose by applying a bound-over tape and sewing through the tape and all plies of the bag. This procedure assures a sift-proof closure. The wire tie closure is an extremely simple, economical and efficient method of closing bags which has found wide success as a closure for multiwall paper bags where the number of units packed does not warrant the installation of automatic equipment. A hand-twisting tool constitutes the entire equipment for securing the wire tie around the neck of the bag.

Stapled closures can be accomplished with a hand stapler or automatic equipment. This type of closure is used for closing open-mouth and open corner bags containing such products as asphalt, resins and coal. The gummed tape closure is accomplished by folding the plies of the bag and sealing the final fold with gummed tape.

The open corner bag has a sewn bottom and the open mouth is partly closed by sewing. In other words, this is an intermediate variety between the open mouth and valve type bag. Open corner bags are often used for packaging commodities which are liquid when poured hot into the bag, but which harden as the product cools. This bag is then closed by stapling the open corner while the product is still in a molten state.

One development now under way in the line of paper bags is the joint work of chemical concerns and the paper bag industry on waterproofed multiwall paper bags, specially sealed at the ends, for carrying subsistence items and vital chemicals to the armed forces. It was decided to conduct large-scale shipping tests, subjecting the containers to severe exposure, handling and transportation abuses in excess of normal conditions.

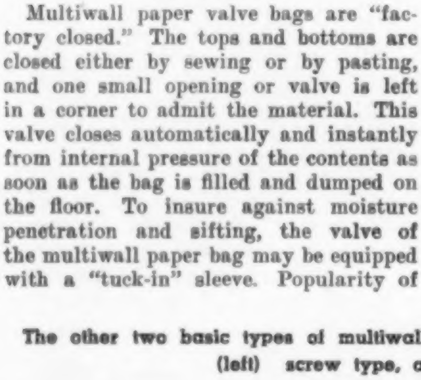
It was found that multiwall paper bags properly constructed are capable of withstanding the hazards of shipping or handling either dry or wet and of providing complete protection against water spray and almost perfect protection against submersion. The "specially" sealed wet-strength multiwall bag, a joint development of these industries, has a resin amorphous wax closure that provides protection against water penetration. The principle of the improved closure is to include in the bag construction a cloth tape, fabricated from starched crinoline laminated to double-napped flannel which allows a greater amount of wax to penetrate all plies at the sewing line, thereby effecting a complete seal against water penetration.

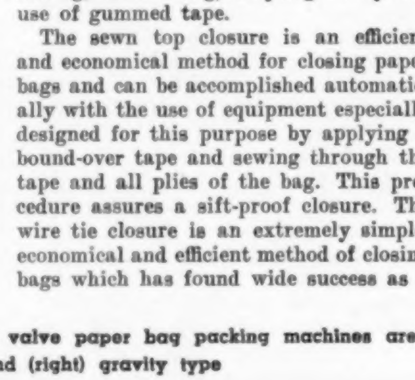
PACKING EQUIPMENT

Where fabric bags have been used, existing bag closing equipment can be adapted to handle paper bags with very slight changes and with a minimum of critical materials. Valve-bag packers, gravity packers, sewing machines or wire tires required for the conversion from critical containers to non-critical paper containers are available to industry.

Multiwall valve bag packing machines are of four basic types; screw, belt, impeller and gravity, so called because these are the methods by which the materials are propelled through the filling tube into the bags. Adjustments and variations of these four types of machines have been developed for the economical packaging of more than 100 products, including many chemicals. The number and

The other two basic types of multiwall valve paper bag packing machines are (left) screw type, and (right) gravity type





Loaves of crude synthetic rubber are being packed in corrugated boxes and paper bags. A special coating liner prevents sticking to the boxes

ze of filling tubes can vary with requirements and machines are adjustable r various bag sizes. Products to be acked can be pre-weighed, or bags can e filled and weighed simultaneously. he simplicity of their operation and he automatic discharge of the filled bag a conveyor has made it possible to mploy women or inexperienced operators operate these machines in many plants xperiencing skilled labor shortages.

Automatic filling and weighing features of the valve packer and the fact hat the valve bag eliminates the necessity of closing equipment has often resulted in a labor saving of approximately 0 percent or more over any method of acking and closing open-mouth type ags.

Free-flowing chemical products can asily be packed in the valve paper bag hrough the use of the gravity type acker, principles of which are shown in e accompanying drawing. This unit, esigned to fill the pre-closed valve-type ultiwall paper bag, is made of sheet etal. However, in an emergency, the verage producer could probably build suitable unit from scrap metal on and with his own shop labor for less han $50.

Rate of production of filled bags depends upon physical characteristics of he material, size of the bags to be acked, and proper installation of the acker. Under average operating conditions, production ranges from eight to en 25-lb. bags, or six to eight 100-lb. ags per min. with one operator.

As an illustration of the performance f this type of packer, a 160-F.B. two-tube valve bag filling machine is taken. This unit can fill chemicals with automatic weighing at a good average output of 20 tons per hour with one operator. When a straight run of a single grade of fertilizer, for instance, is acked, the output may often run up to 0 tons per hour. On the other hand, when the operator must pack 8-10 different grades of small quantities, output may drop as low as 13 tons per hour.

One Pacific Coast petroleum company is now using heavy-duty multiwall paper bags with a special inner sheet for ship launching grease, a product composed of paraffin and other residual waxes from petroleum refining. This is poured into the bags at a temperature of 143 deg. To hold the bags upright during filling and hardening operations, wooden frames have been constructed with hinged sides.

CHEMICAL APPLICATIONS

Calcium chloride is so hygroscopic that moderate moisture cakes it and so deliquescent that excessive moisture sends it into solution. It is packaged at about 205 deg. F. and must be delivered dry and free-flowing. Yet, several years ago multiwall bags were successfully developed for shipping calcium chloride to replace expensive steel drums which were bulky to store and required extra bookkeeping. For this purpose, packaging engineers developed a special asphalt-laminated sheet of kraft paper highly resistant to air-borne moisture and to capillary action. Three of the plies of these bags are kraft and two are of the special paper.

Toughness of these calcium chloride bags is illustrated by the fact that 100-lb. units can be stacked 50 high so that the bags on the floor withstand a 2.5-ton pressure. Bags on the upper tiers often must take a 40-ft. slide for shipment.

Packaged at temperatures as high as 450 deg. F., molten asphalt calls for containers that will resist this heat and at the same time have the necessary strength to cope with the cold flow characteristics of this material. The usual package had been clay-coated steel drums, which were expensive, required large storage space, and had to be destroyed to remove the solidified asphalt. A special coated kraft liner which would withstand high temperatures and prevent the penetration of the molten asphalt into the paper was developed and incorporated into a multiwall paper bag. Importance of this development in conserving critical steel can be seen when it is realized that during the last six months of 1942 alone, the United States armed forces used some 693 million gal. of asphalt. On an average, one ton of asphalt in 20 paper bags can be placed in approximately the same storage space as four barrels of 400 lb. each, or 1600 lb., due to the shape of the barrel. Therefore, asphalt in bags takes less storage space than in barrels.

Lunday-Tagart Oil Co. in Southgate,

These multiwall paper bags are being tested by a 24-hour water spray to determine wet-strength properties for overseas shipment of chemicals

Large tonnages of calcium chloride are packed in special 5-ply multiwall paper bags. Here such bags are stacked 50 high, so that bottom units must withstand a 2.5-ton pressure. Bags on the right are taking a 40-ft. slide down for shipment

Representative Chemical Products Packed in Multiwall Paper Bags

Abrasives	Carbide, cement	Gelatin	Ochre	Sodium aluminate
Activated carbon	Carbon black	Glass, crushed	Oxide (gas purifying)	Sodium formate
Activated oxide	Casein	Glaze spar	Ozokerite	Sodium hyposulphite
Agar-agar	Cement	Glues and pastes	Paint	Sodium nitrate
Alum	Cement compound	Graphite	Paint materials	Sodium phosphate
Aluminum hydroxide	Cement, refractory	Guano	Paris green	Sodium pyrophosphate
Aluminum hydrate	Cement, title grout	Gypsum	Petroleum products	Sodium sulphate
Aluminum powder	Chrome ore	Hydrated lime	Phosphate rock	Sodium sulphate (anhydrous)
Aluminum stearate	Citric acid	Insecticides	Phthalic anhydride	Soya bean flour
Ammonium nitrate	Clay	Insulation	Pigments	Starch, potato
Ammonium phosphate	Cleaner	Iron oxide	Pitch	Sulphate, blue lead
Ammonium sulphate	Copper oxide	Iron, powdered	Plaster	Sulphate, zinc
Ammonium sulphite	Copper sulphate	Kaolin	Plastics	Sulphur
Arsenate of lead	Cyrolite	Karaya gum	Protein	Superphosphate
Asphalt	Dextrines	Lime, agricultural	Pumice	Synthetic gum comp.
Baking powder	Diatomaceous earth	Lime finishing	Pyrophyllite	Synthetic resin
Barytes	Drilling mud	Lithopone	Quebracho	Talc
Basic slag	Drugs	Magnesia	Quicklime	Tanning extracts
Battery mix	Dry colors	Magnesium carbonate	Riboflavin supplement	Tankage
Bauxite	Dust, prec. flue	Magnesium oxide	Rosin	Thermit
Bentonite	Enamel powder	Malt dextrine	Rosin size	T.N.T.
Bicarbonate of soda	Epsom salts	Manganese ore	Rotenone	Ultramarine blue
Bichromate of soda	Explosives	Mica	Rubber, synthetic	Urea
Blood, dry	Facing powder	Mineral cleanser	Rubber accelerators	Volcanic ash
Bone, meal	Feldspar	Mineral wool	Sal ammoniac	White lead
Borax	Ferric sulphate	Mortar cement	Salt	Whitewash
Boric acid	Fertilizer	Mortar mix	Saltpeter	Whiting
Buffing comp.	Fibreglass	Moulding powder	Sand	Wood flour
Calcium arsenate	Fillers	Muresco, white	Sealing wax	Zinc
Calcium carbonate	Fire extinguisher powder	Naphthalene	Silica	Zinc oxide
Calcium chloride	Fluorspar	Neoprene	Silicate of soda	Zirconite
Calcium magnesium chloride	Flux	Nitrate of potash	Slag	
Calcium phosphate	Fly ash	Nitrate of soda	Soap	
Calsomine	Frit		Soda ash	
	Fullers earth			

Calif., consumes an average of 20,000-30,000 multiwall bags per month to pack asphalt at temperatures ranging from 290-310 deg. An open-corner bag with offset sewing is used. Filling is done through a long boom swinging in a semi-circle about 5 ft. from the ground, and equipped with valves and a filling pipe about every 3 ft. of its 50-ft. length. The operator slips the open corner of the bag onto the filling tube and after the bag is filled the corner is closed with a stapler. The bag is then laid on the ground at the point where it was filled to cool and solidify in approximately 48 hours. This is undoubtedly one of the simplest and most economical packing arrangements for such a product. An average of 200 bags an hour can be filled and closed with a two-man crew. The bags have an inside sheet of coated 50-lb. kraft paper, plus three regular 50-lb. kraft sheets.

For normal fertilizers, plain multiwall bags are usually satisfactory; for extremely hygroscopic materials and for shipments into damp areas, asphalt-laminated bags are required. Both open mouth and valve-type bags are used. Price of paper bags is important because of the relative stability of the price of paper in contrast to burlap.

Possible Labor Saving Through Use of Valve Type Paper Bags As Compared With Open Mouth Burlap Bags

Operators	Open Mouth Burlap	Valve Paper Bag
Filling	1	
Weighing	1	
Transferring to sewing machine	1	1
Closing	1	
Loading on hand trucks	1	1
Total operators	5	2
Production, 100 lb. bags per min.	6	8

Multiwall Paper Bags Used for Fertilizers

1939	21,440,000
1940	25,715,000
1941	49,952,000
1942 (1st 6 mos.)	66,173,000

In the case of the cement industry, there were over 197 million fabric bags and 265 million multiwall paper bags used during 1941. However, practically every cement plant in the United States is now equipped to pack its entire output of bag cement in paper without the use of any additional equipment.

In addition to the illustrative uses already mentioned, heavy-duty multiwall paper bags are being used in rapidly increasing quantities to pack solid chemical products, especially those crystalline or free-flowing in nature. Such products, listed in an accompanying table, range from activated carbon to alum, lead arsenate, soda ash, borax, epsom salts, magnesium oxide, pigments, and T.N.T.

Kraft paper for use in multiwall bags has been relatively plentiful, and one of the first indications of possible future conservation measures was the order of July, 1943, which restricted the grade, quality and weight of paper used in the fabrication of paper shipping sacks.

POSTWAR POSSIBILITIES

In the case of metal bulk containers, it must be remembered that few basic changes have been made and that most of the emergency regulations issued by I.C.C. and other agencies will in all probability be rescinded after the steel and shipping emergency has passed. Most of the standardization and other improvements in steel drums, however, will remain and will serve to place these containers in a more favorable position for postwar competition.

There is considerable doubt as to how much of the chemical liquid business tight wooden barrels and kegs will be able to keep in competition with metal containers. While wooden containers have a number of good features, they also have a number of disadvantages that will restrict their use in the chemical field. Initial first cost and the question of returnability will be important factors in which steel drums can offer serious competition. Slack barrels will feel increasing competition from textile and paper containers. Fiber drums are light as compared to metal and can easily be made impervious to moist air. Rapid advancements in the field of moisture-proof and chemical resistant liners offer slack barrels, fiber drums and textile bags the same opportunities for expanding in the field of chemical bulk packaging. In a sense, these developments put all such containers on an equal basis for competition insofar as suitability is concerned for dry chemicals. Relative initial first costs, filling and handling problems and storage requirements will be the basic determining factors, with much depending upon the labor situation.

Versatility, ease of handling and small-space storage requirements of paper bags will give them distinct advantages over certain other types of containers in the postwar period. For instance, 100 heavy-duty multiwall paper bags, capable of packaging five tons of chemicals, can be compressed and stored in about 2-2.5 cu.ft., or much less space than is required for one empty 400 lb. barrel or drum. However, in the postwar era competition will be keen among all package suppliers. During the past few years production of multiwall bags has increased, but the trend has been toward about a billion bags a year. This leveling off is due to a falling off of civilian construction and building activity.

Although the number of multiwall bags produced in 1941 was substantially the same as in 1942, about 50 percent of the 300 or more products now packed in these bags represent new uses, many of which will be retained after the war. In many respects, recenty developed special impregnated papers in the form of laminates compare favorably with plywood, fabric laminates and certain metal alloys and they will probably be permanently substituted for these materials in many container applications for bulk shipping of chemical commodities.

Reprints of this 8-page report are available at 25 cents per copy. Address the Editorial Department, Chem. & Met., 330 West 42nd St., New York 18, N. Y.

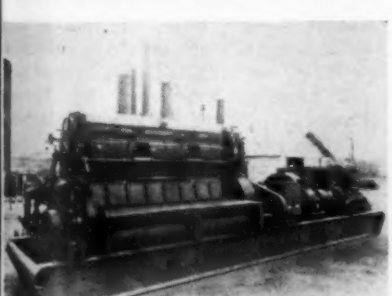
PROCESS EQUIPMENT NEWS

PORTABLE PUMPING UNIT

CONVERSION and adaptation of one of its gas-fueled stationary-type engines, to a portable diesel-powered unit for field service, has been reported by the Cooper-Bessemer Corp., Mount Vernon, Ohio, and Grove City, Pa. Most engines manufactured by this concern are designed for ready conversion from gas to diesel, or diesel to gas operation. The idea reported was worked out by engineers of a large pipe line company of Tulsa, Okla. The diesel unit provides convenient temporary pumping service for transporting crude oil through a trunk line, permitting an increase from 30,000 to 40,000 bl. per day; and can also be used for transporting crude oil from new wells through temporary feeder lines to main trunk lines, thus replacing several engines of lesser capacity.

The complete heavy duty gas unit is a Cooper-Bessemer Type EN eight-cylinder stationary gas engine which was previously installed at a pumping station. It was mounted on a base consisting of 18-in. I-beams, complete with increasing gear, centrifugal pump and all necessary auxiliary equipment, as shown in the accompanying illustration. Once it is placed in desired position, the procedure consists merely in making the crude oil intake and discharge connections after which the unit is ready to handle at least 700 bbl. of crude per hour at 700 lb. pressure. The starting equipment is of the compressed air type, driven by a small engine mounted at the left front end, as shown in the accompanying view. The air storage tank is under the operator's platform. A direct-current generator fitted at the flywheel end provides power for lighting. A heat exchanger, out of sight along the base at the far side, is connected from the discharge of the crude oil pump to the crude oil feeder line, the oil acting as the cooling medium for the exchanger, thus cooling the jacket water.

Stationary gas engine converted to portable diesel power service



New Type M magnetic separator

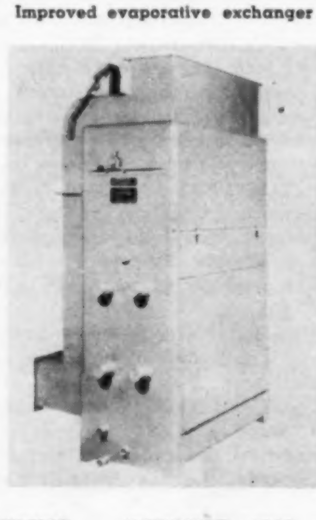
MAGNETIC SEPARATOR

TYPE M is the designation of a new magnetic separator built to operate on the Ball-Norton underfeed lift principle which has recently been designed by Stearns Magnetic Mfg. Co., Milwaukee, Wis. The new separator is partially inclosed in a welded steel housing to exclude foreign material, entering the separation process. Various sizes and belt widths can be supplied to provide any desired capacity and separation. A unique magnetic field is mounted above the lower surface of the separating belt. In operation the mixed material is distributed in an even layer by an automatic feeder to a feed belt which carries the material into the magnetic field where the magnetic portion is lifted by the magnet to the surface of a separator belt. The magnetic field has an alternating polarity characteristic which subjects the magnetically attracted portion of the material to a violent zigzag rolling movement said to release the entrained non-magnetic particles which drop back onto the feed belt and move along to final delivery.

IMPROVED HEAT EXCHANGER

READY CONTROL of temperature in a variety of industrial and chemical processes, as well as control of jacket water temperature for engine, air and gas compressors, is said to be possible with an improved type of Aero heat exchanger recently announced by Niagara Blower Co., 6 East 45th St., New York 17, N. Y. This improvement, which is covered by a recent patent, consists in heating the spray water which is used to spray the evaporative type liquid cooling unit. A steam coil, injector or an electric heating unit can be used for this purpose. The result is to control the liquid temperature within prescribed limits, alternately cooling or heating as required. The heating device is put into operation by thermostatic control, thus preventing the liquid circulated through the heat exchanger from becoming too cold for the process in which it is to be used, or from becoming too viscous, or freezing. This makes it possible for the heat exchanger to be installed satisfactorily out of doors, or to use out-of-door air to increase its evaporative cooling capacity and also to avoid damage from handling air containing corrosive substances.

Improved evaporative exchanger

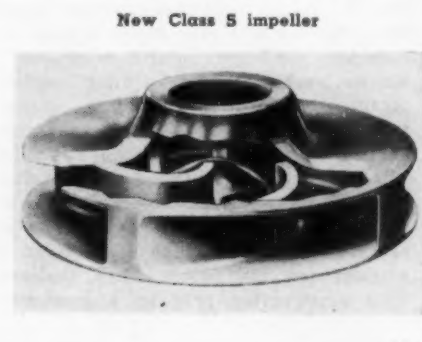


NEW PUMP IMPELLER

IN PUMPING APPLICATIONS where the operating conditions are easy, overall economy calls for a design of impeller which gives maximum hydraulic efficiency but where pumping service is highly abrasive, hydraulic efficiency may become secondary to sturdy design, to ability to pass over-size material, or to resist wear. For the class of applications lying midway between these two extremes, which covers most pump uses, the American Manganese Division of American Brake Shoe Co., Chicago Heights, Ill., has introduced a new impeller design designated as Class S. This new type patented multi-vane impeller is intended primarily for handling finely divided solids, or acids which are erosive or corrosive, rather than truly abrasive.

In the new design hydraulic efficiency is said to have been increased by the reduction of skin friction and by proper hydraulic relation between the impeller and the casing. The impeller ports are comparatively narrow, face seals instead of seal rings are used, and sudden changes in velocity or flow direction are avoided by gradually diverging clear-

New Class S impeller



ance areas and by absence of sharp outside or re-entrant angles. The new type, which is one of a group of impeller designs to suit all applications, has been designed for maximum hydraulic efficiency and high velocities.

PNEUMATIC ATOMIZING NOZZLE

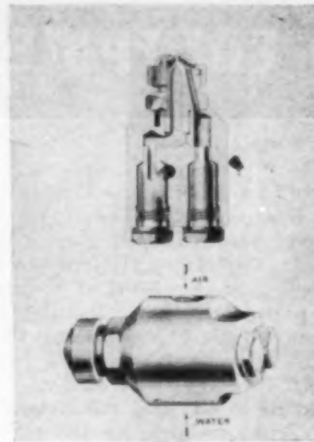
INTENDED primarily for use in humidifying systems, the new Type JHS atomizing nozzle has been developed by Spraying Systems Co., 4023 West Lake St., Chicago, Ill. In this nozzle, as shown in the accompanying illustration, water and compressed air are mixed externally to produce a round spray which is projected 10 to 20 ft., depending on the air pressure used. Since the nozzle is a unit complete in itself, it is easily adapted to all types of installations, according to the manufacturer. The unit contains two Monel metal strainers, one for air and the other for water, which are readily removed for cleaning or replacement without disturbing the nozzle or line. All parts of the unit are accurately machined of brass and given a white metal coating. All parts are readily renewable and are designed for simplified maintenance.

LOW-LIFT ELECTRIC TRUCK

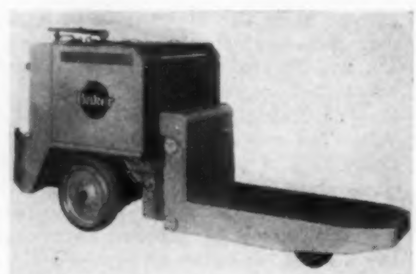
DESIGNED for greater safety of operation through better vision, and for longer hours of uninterrupted operation, a new 4,000-lb. capacity low-lift truck known as Type E-2 has been announced by the Baker Industrial Division of the Baker-Raulang Co., 2168 West 25th St., Cleveland, Ohio. Built on a 66-in. wheel base, with an overall length of 123¾ in., the truck can make right angle turns in aisles 67 in. wide. The battery box has been increased in size to provide space for enough additional battery capacity so that the truck may be operated continuously on the longer shifts generally necessary during the war. Thus, it is not ordinarily necessary to stop during a working shift to change batteries. In the redesign the top front corner of the battery compartment has been chamfered to aid in vision. Other improvements include handles in place of hand holes in the cover of the battery compartment; and an operator's guard built integral with the frame, providing greater strength, additional safety for the operator and better appearance.

SUMP-TYPE LIQUID FILTER

RADIAL-FIN construction similar to that used in its air filters has been applied for the first time by Staynew Filter Corp., 11 Centre Park, Rochester, N. Y., to a new sump-type liquid filter for use wherever dirty liquids are collected, filtered and recirculated. Known as Model SE, the filter consists of upper and lower end plates, joined together by means of a perforated supporting tube over which the radial-fin filter element is installed. The latter consists of an accordion-folded strip of wire mesh formed into a cylinder of radial-fin surface, which is used as a support for the fabric filter medium. This construction provides a maximum



Pneumatic atomizing nozzle

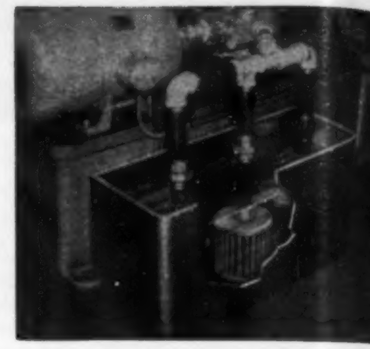

Two-ton low-lift electric truck

of filter area in a minimum of space. The insert may easily be expanded like a bellows for working or brushing the accumulated material from the filter medium to restore it to its original condition. Sizes range from ½ to 2 in. pipe size with from 1.4 to 14.3 sq.ft. of effective filtering area.

FLUID IMPACT MILL

IMPROVEMENTS in its line of fluid impact mills have recently been announced by the Asbury Impact Mill Co., 204 Highland Ave., Abington, Pa. The mill, originally described in our May 1940 issue, has been modified in a number of particulars. It employs a specially designed rotor to produce impact upon a liquid by means of centrifugal force. The rotor divides the liquid into extremely fine particles which are driven by centrifugal action against an impact ring which then directs the fluid film so formed into the periphery of the rotor and thence to the discharge. Speed changes can be effected by changing pulleys, but adjustments of other sorts are unnecessary. Because clearances throughout the mill are large, and because of the large available cooling area, dimensional changes in the mill are said to have no adverse effect, permitting operation at extremes of temperature, either high or low.

The manufacturer recommends the new mill for the production of a wide variety of emulsions in the treatment of such materials as mineral and vegetable oils, latex, waxes, animal and marine oils. In addition to emulsions, the mill is recommended for the dispersion of pig-


Radial-fin sump-type filter


Improved fluid impact mill

ments, clays and fillers, and for the treatment of any material which will flow or can be pumped into the mill. The use of multiple admission ports, permits the feeding of several of the materials simultaneously, so that a finished emulsion can be made in one continuous process.

ANTI-FRICTION PUMP

NOW AVAILABLE for general industrial use is a new series of rotary pumps with anti-friction bearings which has recently been added to the line of standard units manufactured by Blackmer Pump Co., Grand Rapids 9, Mich. Capacities range from 10 to 750 g.p.m., at pressures up to 150 lb. per sq. in. The new design has the advantage of reducing power requirements and permitting higher operating pressures. As the bearings are in contact with the liquid being pumped, the new units are recommended only for handling those liquids which have lubricating properties, such as oils, molasses and similar materials. The pumps are available in all-iron or in bronze-fitted construction, with or without removable liners. Steam-jacketed heads can be supplied if desired. All standard drives may be secured, including the gearhead motor type.

IMPROVED FLARING TOOL

OWING TO present government restrictions on the use of copper and aluminum, some time ago Everhot Products Co., 2055 West Carroll Ave., Chicago, Ill., developed Bundyflex soft steel tubing with copper coating to take the place

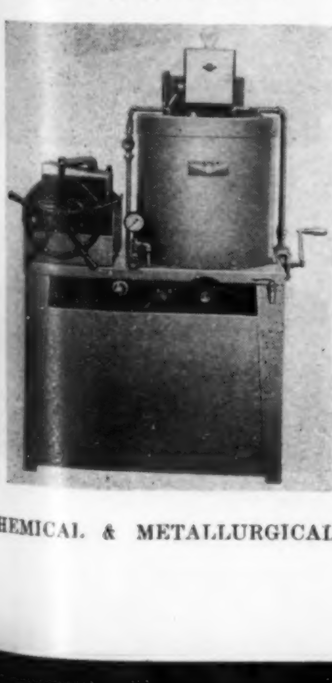
of critical metal tubing. This concern has now introduced a new flaring tool known as the Flaremaster, which has been designed to produce a double-strength flare. The tool is suitable for use on both ferrous and non-ferrous tubing in sizes from ⅛ to ⅝ in. o.d. The flare produced by the new flaring tool is of the double-lap type in which the end of the tube is folded inward to produce a double thickness of metal in the flare. This type of flare is said to offer greater resistance to vibration fatigue, and to eliminate split and cracked tubes and reduce breakdowns and service cost. The tool consists of three parts, two folding jaws, and a U-shaped clamp with a built-in vise. Wearing parts and punches are of hard steel. Two types of punch, a forming punch and a flaring punch, are required for each size of tubing in making the double flare.

IMPROVED A.C. GENERATOR

Model 55 is the designation of a new Katolight generator rated at 25 kw. at 80 percent power factor, single phase, or 30 kw. at 80 percent power factor, three phase, recently announced by the Kato Engineering Co., Mankato, Minn. The new generator is of the revolving armature type, separately excited and designed for direct attachment to the engine bell housing. It is available in all standard voltages and in single- or three-phase designs. The armature core is internally cooled, the generator is equipped with a large cooling fan and with grease-sealed bearings. Brushes and brush-holders are readily accessible, and the brushes are of a high-carrying-capacity, long-life type.

New 25-kw. a.c. generator

Small-capacity oil reclaimer



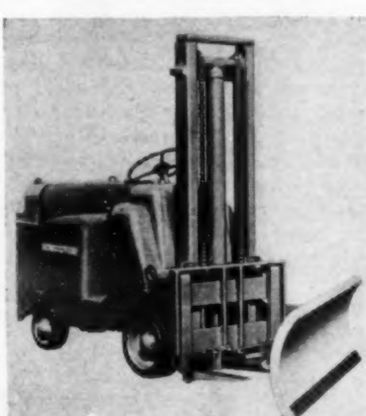
SMALL-CAPACITY OIL RECLAIMER

For reclaiming waste lubricating oils drained from equipment, as well as the recovery of truck and automobile fleet crankcase oil in smaller plants, the Youngstown Miller Co., Sandusky, Ohio, has developed a small oil reclaimer with a capacity of 8 gal. of dirty oil in 70 to 90 min. Operated only once a day the unit is claimed to recover 2,500 gal. of waste lubricating oil per year, and thus to pay for itself in 6 to 12 months. The equipment employs a two-stage filter press, is semi-automatic, operates under thermostatic control and utilizes common refinery clays which are available in the open market. As in the case of the seven larger units made by this company, use of the small unit is said to restore used oils to substantially the same values of flash, viscosity, color, neutralization and precipitation number as the original oil.

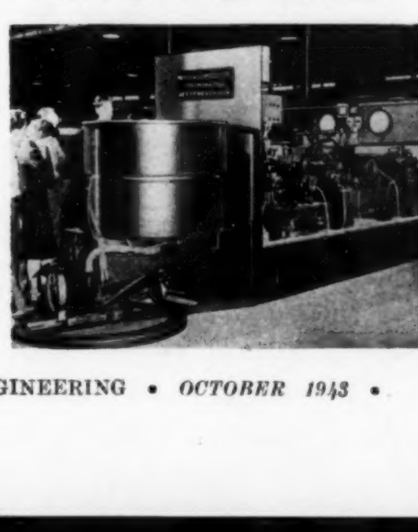
SNOW PLOW ATTACHMENT

Adding to the versatility of its line of lift trucks, the Towmotor Corp., 1226 East 152nd Street, Cleveland, Ohio, has developed a snow plow attachment for the removal of heavy blankets of snow which next winter may hinder materials handling operations in storage yards and on unprotected loading platforms. The safety-blade-type plow is attached to the truck's standard forks merely by positioning and tightening a set of simple two-bolt drawclamps. No adjustments, other than setting the forks at maximum width, are necessary. After plowing, the attachment is easily removed so that the truck can go on with its normal assignment. The plow blade, as shown in the accompanying illustration, is inclined at such an angle that it acts as a safety trip and permits the plow to ride safely over ordinary road obstructions. The model illustrated has a 23-in. high moldboard, is 64 in. in overall length and has a plowing width of 53 in. when set at the extreme angle. Spring-trip models and models for greater widths are also available.

Lift-truck-powered snow plow



Low temperature plasma desiccator



BLOOD PLASMA DESICCATOR

Development of a new type of refrigeration machine designed for desiccating blood plasma serums and water soluble medicaments has been announced by the Deepfreeze Division of Motor Products Corp., North Chicago, Ill. The first of these machines has been built and is in operation in the plant of Parke-Davis Co. The new machine employs features developed in conjunction with this company's line of industrial chilling machines. One is utilization of the expansion and contraction of the chilling chamber itself, in conjunction with a Microswitch, to insure infinitely variable temperature control. Another is the use of a superheat suppressor and a highly efficient oil separator to remove oil from the refrigerant and return it to the compressor.

EQUIPMENT BRIEFS

A new line of electronic heaters for high-frequency induction heating of metal parts has been announced by the General Electric Co., Schenectady, N. Y. Essentially power oscillators which convert 60-cycle power to high-frequency power at approximately 500,000 cycles, the new heaters are available in two standard sizes, one having an output of 5 kw. and the other an output of 15 kw. The design is based on experience with more than 100 installations of these heaters in several of the company's own plants.

A new asbestos-cement conduit, intended primarily for cable installation, is now being produced by The Philip Carey Mfg. Co., Lockland, Cincinnati, Ohio. An important feature is the new Flexcaulk coupling supplied with the conduit, which consists of a tubular housing of asbestos-cement to which is bonded a liner of mineralized asphalt compound formed into a barrier-type tapered liner which forms a flexible, self-aligning, water-tight joint when assembled with a special joint-sealing compound. Only unskilled labor and simple tools are required, according to the manufacturer, in cutting and assembling this conduit.

Availability of the Speare's safety siphon through its own organization has been announced by Pulmosan Safety Equipment Corp., 176 Johnson St., Brooklyn, N. Y. This siphon, which has previously been described in *Chem. &*

Met. (January 1943, p. 109) uses a vacuum priming principle for discharging acids and chemicals from carboys, drums and barrels, and is made of acid-resisting plastics, having no glass parts.

A NEW vibrating packer for the packing of a wide variety of powdered and granulated materials has been announced by the Ajax Flexible Coupling Co., Westfield, N. Y. The machine consists of a low platform mounted on coil springs to prevent transmission of vibrations to the floor or surrounding structure, powered by means of one of this company's Ajax-Shaler shakers which is a self-contained, automatically balanced, mechanical vibrating unit inclosed in an oil- and dust-tight housing and powered by means of a small belt-connected motor.

FOR THE internal cleaning of machinery gear cases, inclosed transmissions, oil reservoirs and lines, heat exchangers and other equipment, Circo Products Co., 2835 Chester Ave., Cleveland 14, Ohio, has developed a new type of vapor degreasing machine used for internal, rather than external cleaning. It is made in two types, one a large size steam-heated model, and the other a smaller model which is portable and electrically heated, but also fully automatic. In either case, the machine vaporizes a special solvent which is led into the equipment to be cleaned, the vapor condensing and flowing out, carrying with it dirt and grease.

OWING to the growing need for a simple compact instrument suitable for measuring the flow rate of gases such as oxygen, the Pittsburgh Equitable Meter Co., 400 North Lexington Ave., Pittsburgh, Pa., has developed the Emco flow indicating meter which is calibrated in liters of oxygen per minute. This meter is made entirely of metal, operating on the principle of a floating piston whose positioning is actuated by the flow of gas through an orifice of variable area. Four sizes are available for indicating maximum rates of flow from 2 to 150 liters per min.

A NEW 500-amp. outdoor alternating current welder has been announced by the General Electric Co., Schenectady, N. Y. The new welder, which has a welding current range from 100 to 625 amp. at 40 volts, is especially designed for outdoor locations where weather exposure is encountered. In addition to protection against the weather, it incorporates all desirable features found in the company's indoor a.c. welders of this type, including built-in power factor improvement, which provides low current imput by maintaining the power factor at 95 percent or better at all loads between 40 and 70 percent of rating.

CLOSE CLEARANCE PUMP

DESIGNED particularly for the petroleum refining industry is a new close clearance reciprocating steam pump, manufactured by the McGowan Pump Division of Leyman Manufacturing Corp., 20 Central Avenue, Cincinnati, Ohio. Pumps of the new design employ bronze bushed valve gears and piston valves. Fluid ends are designed for 400 lb. suction pressure and 600 lb. discharge pressure. Pumps incorporate extremely deep stuffing boxes and ample studding. Cast sections are said to be more than ample for the designed pressures. Water jacketed stuffing boxes, and priming valves, are optional equipment. Steam ends are designed for operation on steam at 250-lb. pressure.

CONDUIT FOR PROCESS LIQUIDS

WITH a new system developed by the Ric-wiL Co., Union Commerce Bldg., Cleveland, Ohio, process liquids can be piped relatively long distances, with desired temperatures maintained. Any specified combination of pipes can be furnished in a pre-fabricated conduit, with insulation so arranged that the pipes are insulated from the exterior but not from each other. The conduit may be of helical corrugated material, coated and wrapped with asphalt saturated asbestos felt, and available in lengths of 21 ft. for speedy installation. A tile system, shown in the accompanying illustration and based on the same principle, is also available, using a diatomaceous earth lining molded and keyed to the inside of the tile. The new system is adaptable to underground or overhead installations and is equally suited for hot or refrigerated process liquids of all kinds. A steam or hot water line may be used to heat liquids in other lines if desired.

WATER PURITY METER

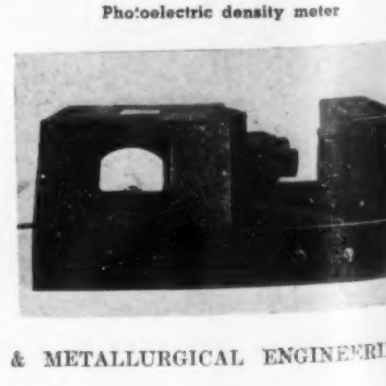
CHECKING of the purity of distilled water can be accomplished quickly and without the use of specially skilled help by means of the new Barnstead purity meter announced by Barnstead, Still & Sterilizer Co., Forest Hills, Boston, Mass. To make a purity check of distilled water the temperature of the water is taken first. Then a dial on the meter is set at the corresponding temperature. Finally, the conductivity cell is immersed in the distilled wa[ter] a dial is moved until the cathode-[ray] "eye" indicates the correct setting, [and] the reading of the second dial is tak[en] to indicate the impurity content of [the] water in parts per million expressed [as] sodium chloride. The instrument is [a] compact conductivity bridge weighi[ng] only 3½ lb. which operates direct fr[om] 110-volt, 60-cycle current.

PHOTOELECTRIC DENSITOMETER

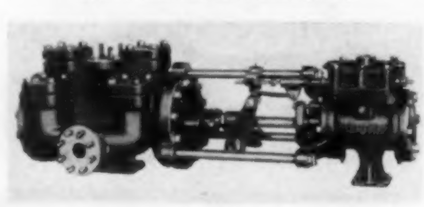
PHOTOELECTRIC measurement and co[n]trol of the density of transparent film[s,] filters, plastics, gases and liquids [is] available in the new Densitometer, S[e]ries D90, recently announced by Phot[o]switch, Inc., 77 Broadway, Cambridg[e,] Mass. Originally developed for use [in] the manufacture of extremely dense o[p]tical filters, to maintain accurate co[n]trol of transparency during large qua[n]tity runs, the instrument is said to [be] equally suitable for constant densit[y] control of films and plastics, and f[or] turbidity control of liquids and gase[s.] The instrument, which has been designe[d] for extreme accuracy of measureme[nt,] projects two beams of light from [a] single light source. One beam pass[es] through a standard filter, and the oth[er] through a filter, liquid or solid, th[e] transparency of which is to be measure[d.] The two light beams are then projecte[d] by an optical system to a single phot[o] tube. By means of an electronic an[d] mechanical timing system the instru[-]ment constantly measures the ratio o[f] the transparency of the sample as com[-]pared with the standard filter. As th[e] same photo tube and amplifying syste[m] are used in both systems, the resultin[g] measurements are said to be completel[y] independent of circuit constants. Th[e] new instrument, which is intended fo[r] measuring materials up to density 5, ca[n] be supplied to meet individual trans[-]parency specifications and productio[n] control requirements.

Purity meter for distilled water

Photoelectric density meter



Improved close clearance pump



Insulated tile conduit for process liquid lines

HYDROGEN SULFIDE

NITROGEN

OXYGEN

HYDROGEN

CARBON MONOXIDE

BLUE WATER GAS

ORGANIC SULFUR

HYDROCARBONS

CARBON DIOXIDE

A typical gas purification plant

Processes for gas manufacture, purification, separation and dehydration . . .

THE GIRDLER CORPORATION

Gas Processes Division · Louisville, Kentucky

GIRDLER

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★ BUY ANOTHER WAR BOND THIS WEEK

CORDITE

Made in Canada

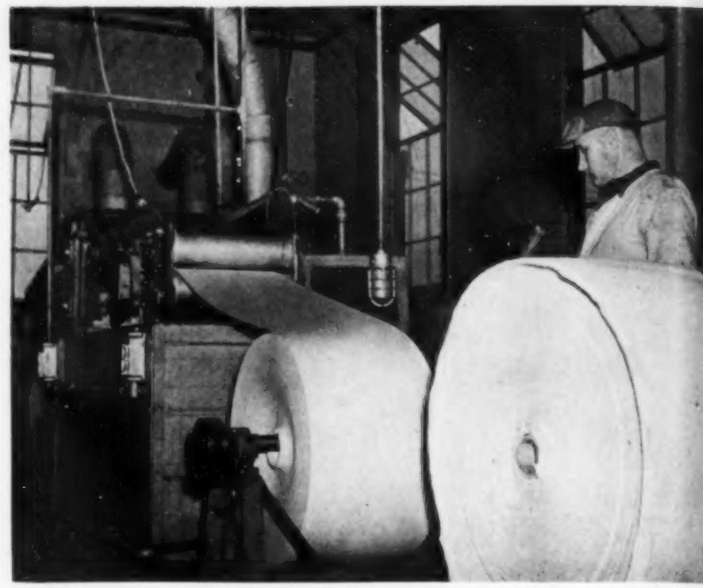
THE STORY about cordite is that while its two main constituents are high explosives, the product itself is not. On the contrary, it is a relatively slow burning explosive suitable only as a propellant. It is used in cartridges where the purpose of the charge is to heave the shell out of the gun. Another use is as a propellant for various types of rockets and rocket guns.

Cordite was developed by Sir Frederick Abel and Professor Dewar and consists of a mixture of nitroglycerine and nitrocellulose, gelatinized with the aid of a solvent. It is being made at Transcona, Man., Canada. Woodpulp is first treated with mixed acids to form crude nitrocellulose, which is then boiled for from four to six days, using several changes of water. The nitrated fibers are beaten in a papermaker's beater, having a large roll on the outside of which are metal knives. These knives chop the fibers shorter, and also loosen any impurities adhering to them. After thorough washing and removal of grit and other foreign matter, the nitrocellulose is put into a centrifugal wringer which removes most of the water. A hydraulic press removes more of the moisture. While still in the press alcohol is forced through the compressed guncotton, replacing the water. The guncotton leaves the press in the form of a hard cylindrical cake moistened with alcohol. This cake is broken up in a kneader and the nitroglycerine-acetone mixture is added. The alcohol-acetone dissolves the fibers and forms an amorphous plastic mass. Several chemical stabilizers and other chemicals designed to impart special characteristics are added to the mass while it is in the kneader. It becomes a crumbly dough and is transferred to another press which has orifices of a predetermined size in one end. The raw cordite is extruded in the form of long cords which may be varied in thickness. These cords are cut in convenient lengths, placed on trays and conveyed to the "stoves". Here they are subjected to a continuous stream of warm air which removes the acetone-alcohol solvent. This is collected in a recovery system for re-use. As each batch of cordite exhibits slightly different characteristics, the usual practice is to blend a number of batches together. This is done by several blenders, placing strips from various batches on a moving belt. The blended material is packed in wooden cases with a waterproof inner liner and shipped to either magazine storages or the ammunition filling plant.

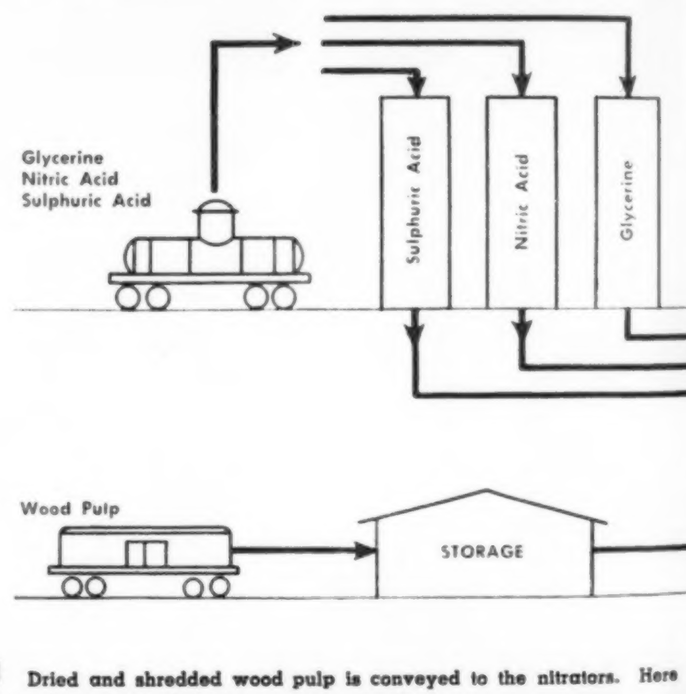
CHEMICAL & METALLURGICAL ENGINEERING

October, 1943

PAGES 130 to 133



1 Rolls of wood pulp are fed into a shredding machine which reduces the pulp to a fine fluff much like short fiber cotton batting



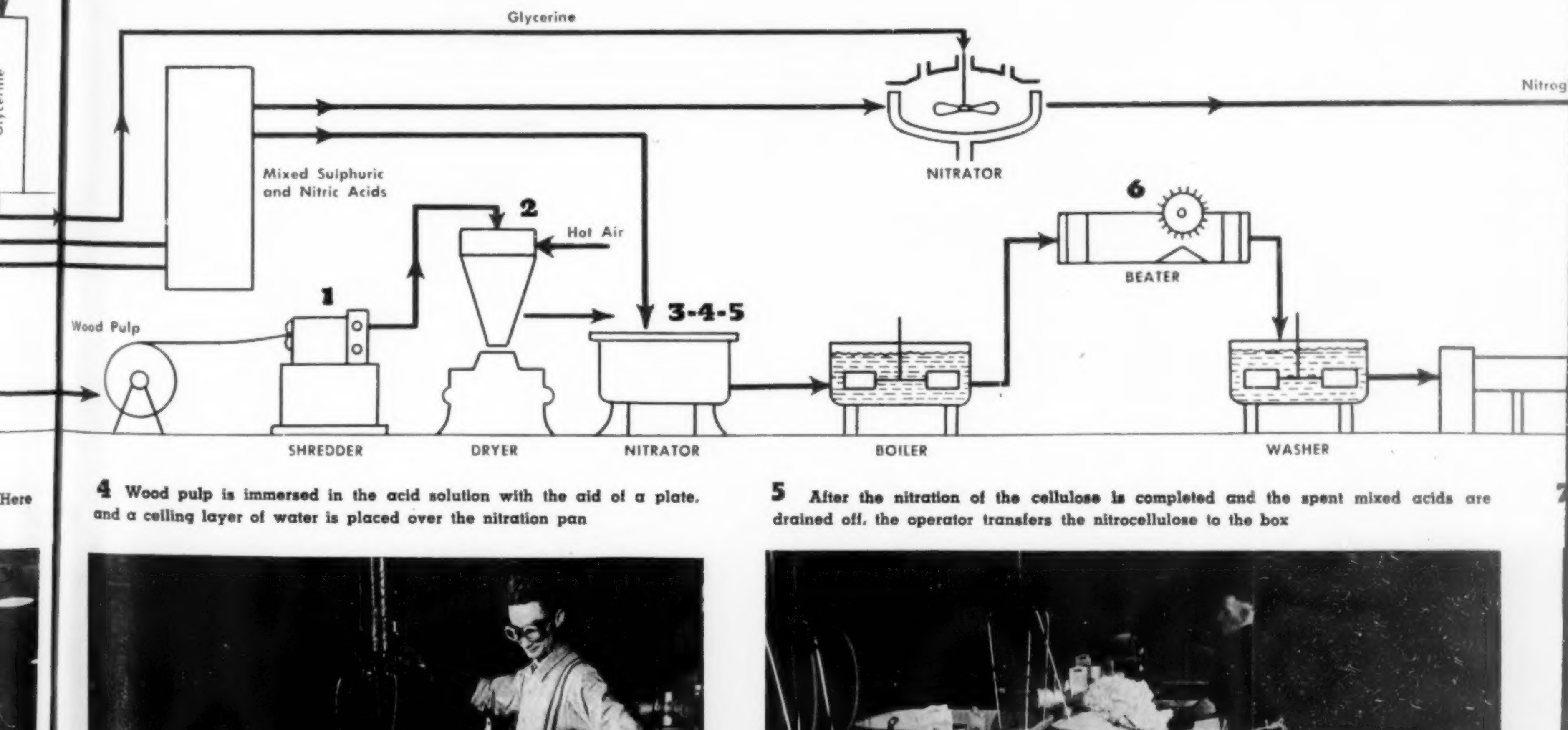
3 Dried and shredded wood pulp is conveyed to the nitrators. Here the pulp is being forked into open nitrating pans

educes

2 Shredded wood pulp is dried by a current of hot air

6 Nitrated fibers are put into a beater. Metal knives chop the fibers and loosen the impurities adhering to them

8 Cleaned material is put into a centrifug remove most of the water from the cellulose

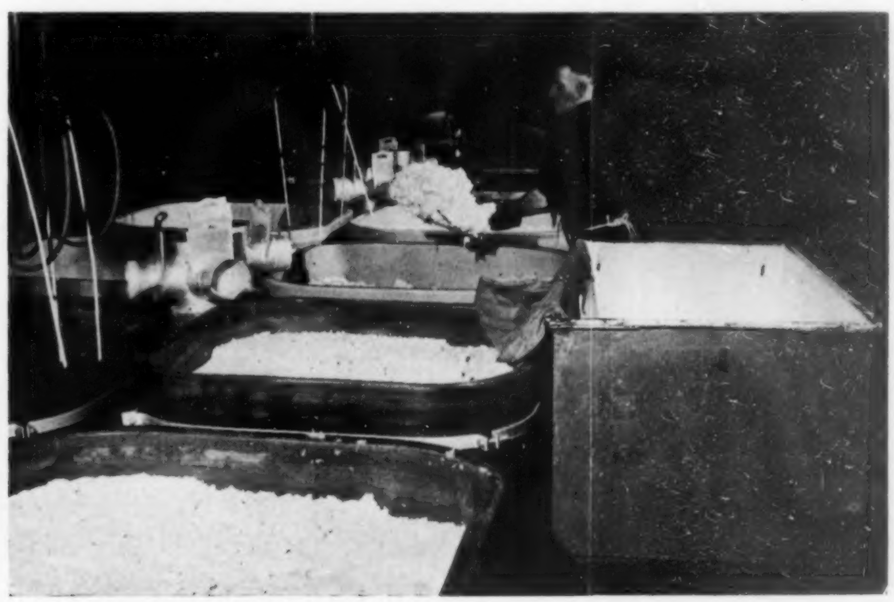


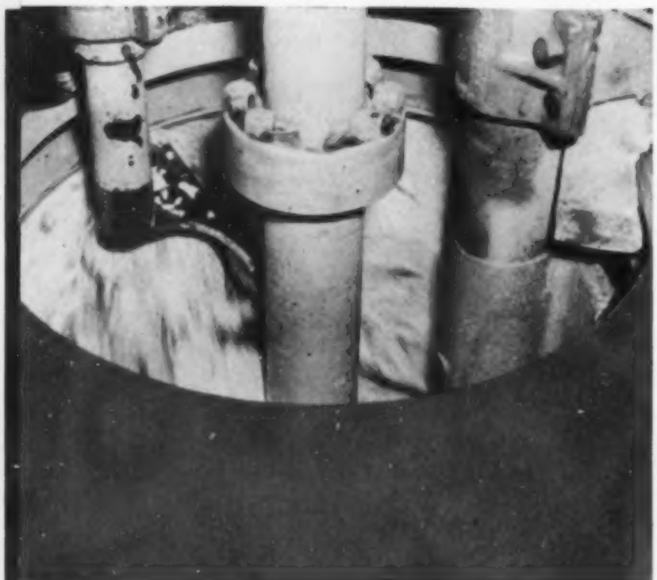
Here

4 Wood pulp is immersed in the acid solution with the aid of a plate, and a ceiling layer of water is placed over the nitration pan

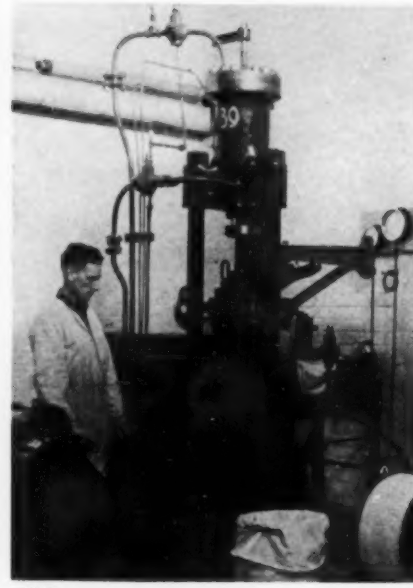
5 After the nitration of the cellulose is completed and the spent mixed acids are drained off, the operator transfers the nitrocellulose to the box

7



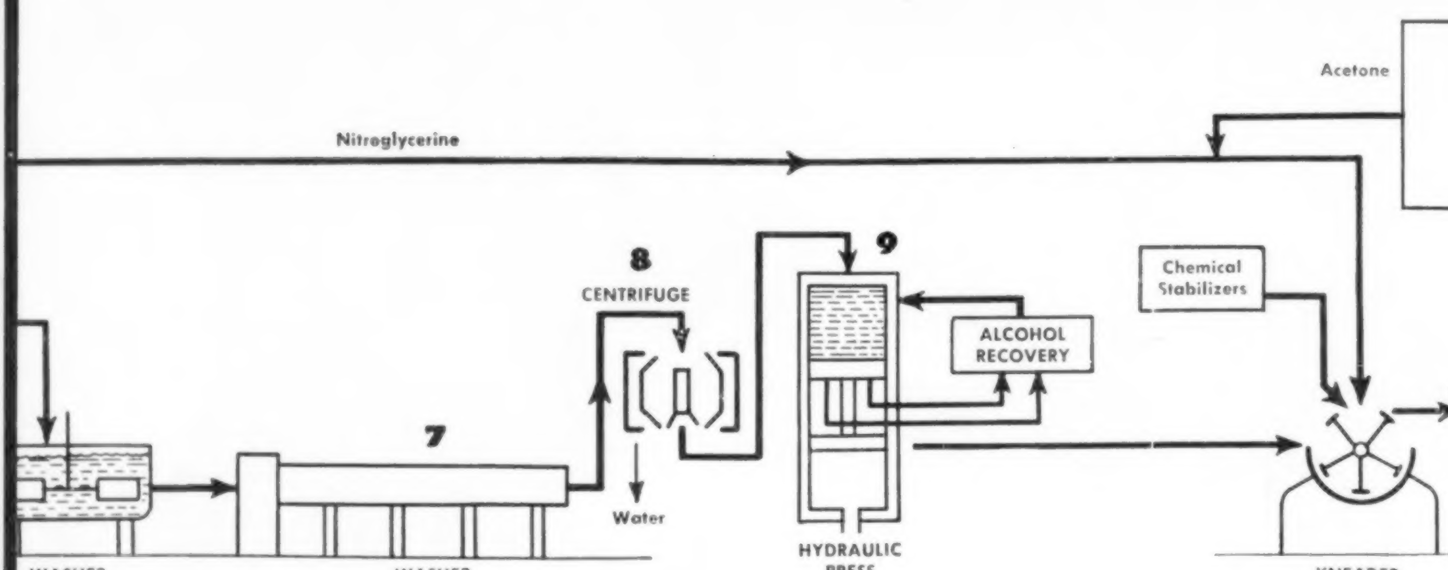


ned material is put into a centrifugal wringer in order to most of the water from the cellulose



10 Hydraulic presses extrude the cordite through small holes

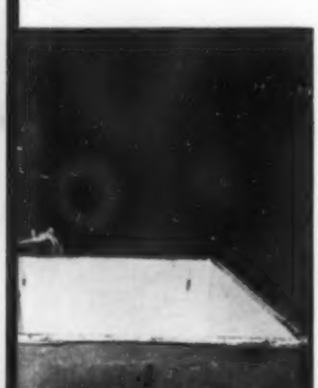
12 These young wome placing cordite in special

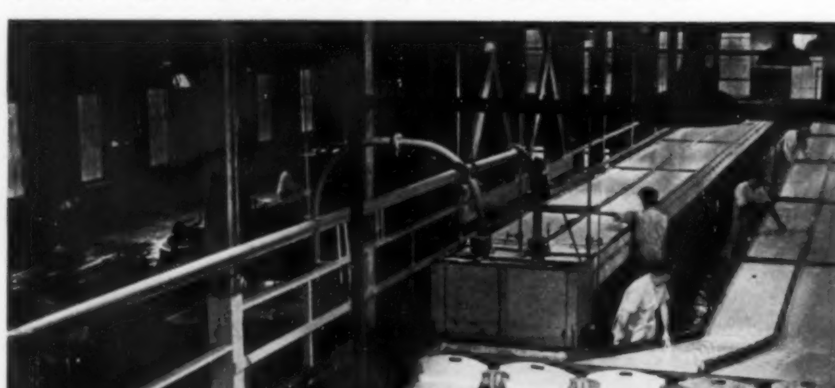


the spent mixed acids are box

7 From the beaters the fibers of nitrocellulose are conveyed to a washer and purification system where grit and other foreign matter are removed

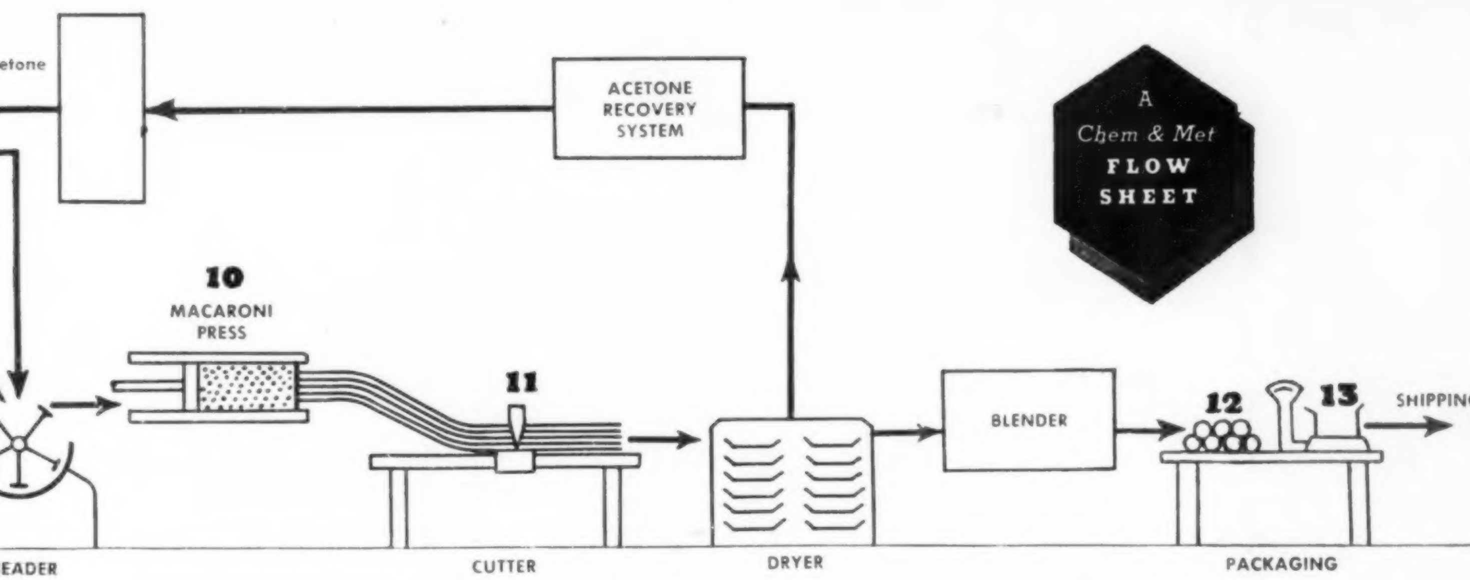
9 In the hydra which is pressed





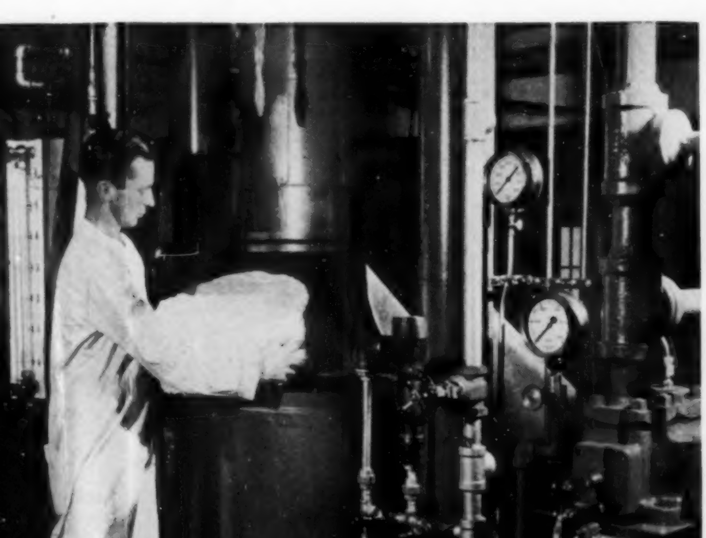
young women in a large Canadian explosives plant are
te in specially prepared silk bags

13 The final blending material is packed in wooden cases with a waterproof inner liner and shipped to either magazine storages or the ammunition plants



In the hydraulic press alcohol is substituted for the remaining water
ch is pressed out. Operator transfers cake to a kneader

11 As the long strips of extruded cordite come from the presses they are cut into specified lengths for packaging



"Specially Engineered"

FOR SYNTHETIC RUBBER PRODUCTION

Selected by the Rubber Committee for installation in all standard synthetic rubber plants of the Rubber Reserve Corporation, these proportioning pumps for blending regular and off-grade latex are typical of the several types of proportioning equipment developed by %Proportioneers, Inc.% for the synthetic rubber and other process industries. As pioneers in the development and perfection of proportioning equipment, long experience in allied industries is brought to bear on each specific problem. With complete manufacturing facilities "under one roof", %Proportioneers, Inc.% control every step in the production of their equipment — from casting to final inspection. Such close supervision, through every phase of machining and assembling, assures uniform high quality in every %Proportioneers% unit . . . and guarantees delivery on time.

Write for descriptive Bulletin 1700

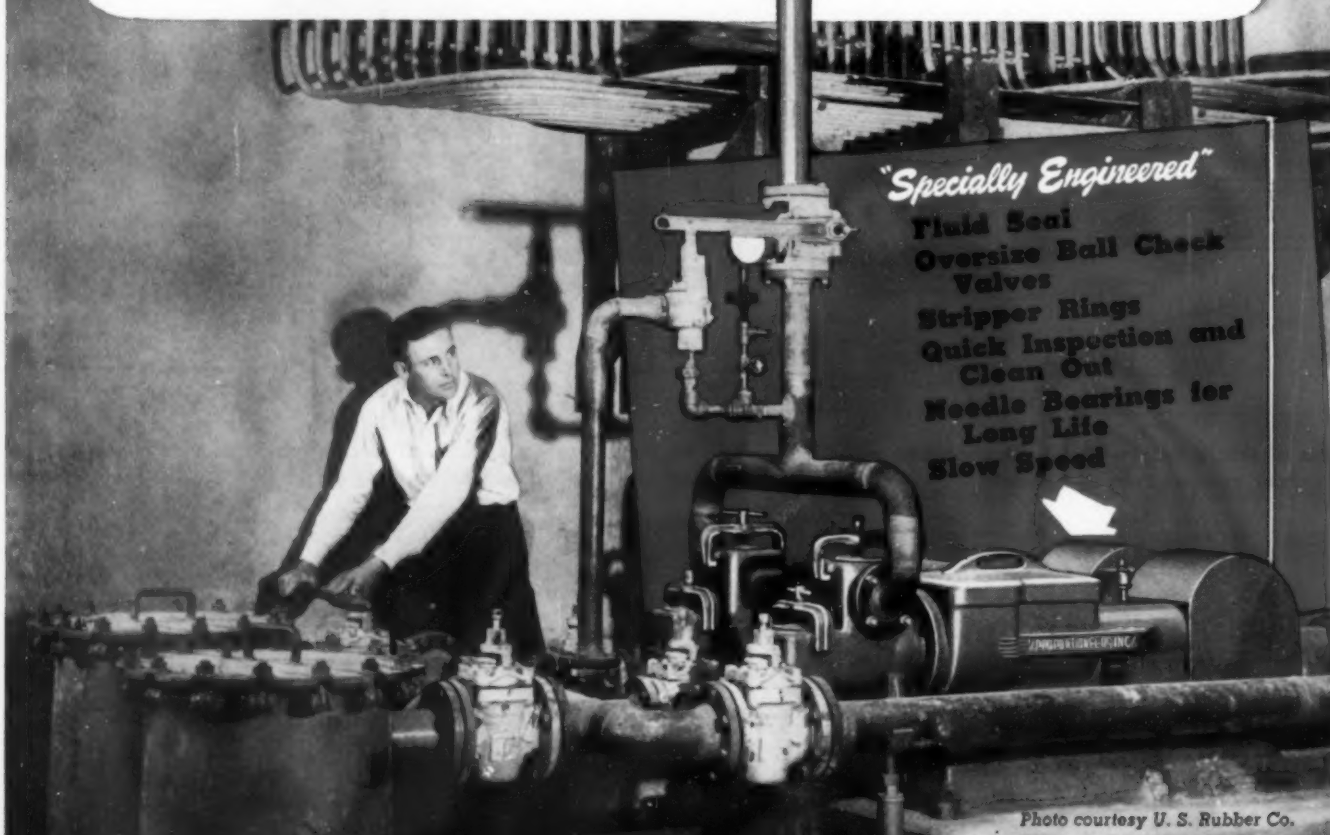


Photo courtesy U. S. Rubber Co.

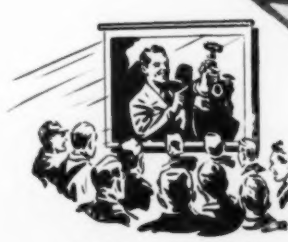
% PROPORTIONEERS, INC. %

WRITE TO %PROPORTIONEERS, INC.%, 29 CODDING STREET, PROVIDENCE 1, RHODE ISLAND

STILL greater shortages of man power and reduced supplies of vital equipment are threatened by war. Yet no plant can operate efficiently without adequate care for its piping systems.

Seeing and hearing this film will give new, inexperienced maintenance workers a quicker grasp of their jobs—a clearer understanding of how to handle valves, fittings, and piping accessories to keep pipe lines flowing with fewer interruptions. To "old timers" it will recall many forgotten "tricks of the trade."

As the leading maker of valves and fittings, Crane Co. offers this film in today's emergency—to share with all industry—its 88-year experience in flow-control engineering. "Piping Pointers" will be available for showing in any plant, trade school or industrial training center.

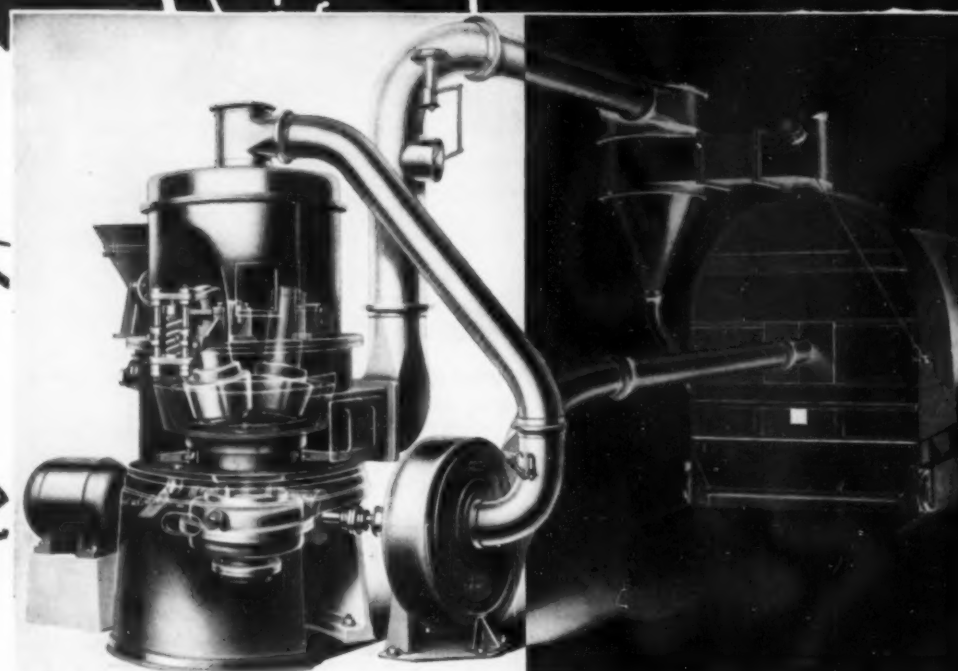


Made on 16mm. film. Showing time approximately 30 minutes.

Showings Arranged by Your Crane Branch

The Crane Branch serving your area will gladly supply full information about "Piping Pointers" and arrange a convenient showing in your plant. Reserve a date for an early showing by calling your Crane Representative today. CRANE CO., General Offices: 836 S. Michigan Ave., Chicago 5, Ill.

CRANE VALVES



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The pressure for higher production in the chemical industry can only be met by the use of machines capable of continuous operation.

For direct-firing of kilns, stills and furnaces with powdered fuel, the Bowl Mill answers all requirements. It is built for non-stop service . . . running months at a time without shutdowns . . . may be lubricated and adjusted, including compensation for wear on the rolls, while in operation.

Equally important . . . the Bowl Mill can handle any grade or moisture coal . . . substituting to advantage for the critical fuels, oil and gas.

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Chemical Engineering NEWS

ACS COMMITTEE FORESEES LACK OF TECHNICAL WORKERS

The supply of chemists and chemical engineers is drying up at the source, and within a year or two there will be no more fully trained graduates in these fields, according to a report of the Committee on the Professional Training of Chemists of the American Chemical Society, of which Professor W. Albert Noyes, Jr., of the University of Rochester, is chairman.

It is impossible, the Committee points out, for students to meet the training requirements established by the Society within the time limitation of twenty-four months imposed by Selective Service.

"The maximum time now allowed by Selective Service for deferment of students of chemistry and of other fields of technology is twenty-four months," it is explained. "It is the opinion of the committee that the present requirements cannot be met in less than two and two-thirds calendar years which would include eight semesters in an accelerated tri-semester schedule.

"At present freshmen and sophomore students become eighteen years of age before they are within twenty-four months of graduation and cannot be deferred. The stream of technical students is therefore drying up at the source. Already the enrollment is down to about one third of normal. Unless some provision is made for a longer period of deferment for chemists and engineers, within one or two more years there will be no fully trained graduates in these technical fields."

TECHNICAL ADVISORY SERVICE FOR SMALLER WAR PLANTS

A Technical Advisory Service set up by regions throughout the country to serve the interests of small plants has been established by the Smaller War Plants Corp. The Service will put at the disposal of the small manufacturer who requires technical research in the solution of a production problem, information drawn from governmental agencies, trade associations, technical and scientific organizations, technical magazine editors, and the research laboratories of educational institutions and private industry.

This is the first time that small plants have been given the opportunity to obtain technical information through one central government agency and is expected to be of tremendous assistance to small manufacturers in rounding out their production capabilities. The Technical Advisory Service springs from an idea which has been applied successfully in private business since 1937 by Bert H. White, vice-president of the Liberty Bank of Buffalo, now on leave to serve as a major in the Army Air Forces.

CHEM. & MET. EDITOR ON TRIP TO SOUTH AMERICA

James A. Lee, managing editor of *Chem. & Met.*, and former head of the rubber and plastics section of the Bell Telephone Labs., took off from Miami Oct. 8 for an airplane trip to the Latin American centers of rubber development.

James A. Lee

Under guidance of the U. S. Rubber Development Corp., the party of which Mr. Lee is a member will inspect the cryptostegia plantings in Haiti before proceeding by plane and boat to the rubber plantations of the Amazon Valley. Prior to his return to the United States early in November, Mr. Lee also intends to study the mineral and industrial resources of Brazil and Bolivia.

ADDITIONAL INFORMATION ON STEARIC ACID FLOWSHEET

In the *Chem. & Met.* Pictured Flowsheet on Stearic Acid, Red Oil and Glycerine, which appeared in the September, 1943, issue (pages 132-135), there are illustrations of a Monel metal-lined saponifier and an Inconel still. It may have been inferred that some other metals had been used.

ROSTER REVIEW RETAINED IN NEW DRAFT ORDER

National Roster continues as the adviser on selective service cases involving professional chemical engineers and chemists. The procedure has changed slightly under the new order to local boards; but the Roster continues as official adviser from Washington to the U. S. Employment Service on cases with which they have diffculty because of lack of professional information.

To accelerate handling of deferment inquiries for professional men, the National Roster has substantially enlarged its Allocation Division. The Division will be headed by Dean William T. Read, formerly of Rutgers University and recently in charge of the chemical work of the Roster. He will be assisted by Dr. Harry Barnard on chemical cases. The work on physics and mathematics will be handled, as formerly, by Dr. M. H. Trytten. All engineering cases except chemical engineering will be handled by Montgomery P. Case. Chemical engineering cases are handled in the Chemical Division.

L. D. TOMPKINS NAMED DEPUTY RUBBER DIRECTOR

Rubber Director Bradley Dewey has announced the appointment of L. D. Tompkins, of Wilton, Conn., as deputy rubber director. The new deputy director will also continue in charge of the operations division of the Office of the Rubber Director.

Mr. Dewey also announced the appointment of Earl B. Babcock of Akron, Ohio, as an assistant rubber director in charge of product development and conversions; Frank Creedon of Brockton, Mass., as an assistant rubber director in charge of construction; and of Dr. Edward R. Gilliland of Cambridge, Mass., as an assistant rubber director in charge of research and development.

AGRICULTURAL CHEMISTS WILL HOLD CONFERENCE

A special war conference will be held by Association of Official Agricultural Chemists, with headquarters at the Statler Hotel, Washington, October 27-28. The importance of food control methods and close cooperation in food and drug testing between Federal officials and representatives of States and industry gives special importance to this session. The customary review will be given to standard methods, both those of tentative and permanent form.

SALT COMPANY GIVES FORECAST OF POSTWAR BUSINESS

THAT business in this country will decline slightly in the year following peace, drop off sharply the following year, and then resurge rapidly almost to the record 1943 level is indicated by an interesting forecast based on salt production and announced by the International Salt Co. Inc.

The actual forecast of salt production in post-war years is based on a formula used by the International Salt Company, which in the past has been accurate within 3 percent. A forecast made in 1939 covering last year's production of evaporated salt, rock salt and salt in brine form, came within six-tenths of 1 percent of the actual 1942 tonnage.

According to this forecast, peak production of salt will come this year, when 14,048,000 tons will be produced. In 1944 there will be a slight drop to 13,636,000 tons. Production will remain at about that figure for a year after the end of the war. The second year after the peace will, however, bring a sharp decline to 9,506,000 tons, resurging the following year to 12,632,000 tons. A further gain to 13,388,000 tons can be expected the next year, followed by a drop to 12,582,000 tons, and then another rally to 13,806,000 tons.

ANTIFREEZE USES DESCRIBED IN ODT BOOKLET

THE GOVERNMENT is seeking to use the technical skill of the motor industry to ensure maximum benefit from antifreeze in the cooling system of industrial cars and trucks. Office of Defense Transportation has issued a booklet entitled "Cooling System: Cleaning, Flushing, Rust Prevention, Anti-freeze." This can be secured by interested industrial executives from Office of Defense Transportation, 1147 New Post Office Building, Washington, D. C., without charge.

The importance of the pamphlet lies in the sound technical recommendations which have been formulated by one of the outstanding technical committees of the Society of Automotive Engineers. Shortage of antifreeze materials can be offset and the benefits of a permanent non-evaporating antifreeze obtained best by following these instructions, especially on industrial vehicles. The Government is anxious that this pamphlet be widely studied and its recommendations applied in practice.

EXHIBIT SPACE FOR CHEMICAL SHOW CONTRACTED FOR

ARRANGEMENTS for the 19th Exposition of Chemical Industries have been practically completed. The Exposition will be held at Madison Square Garden, New York, opening on Monday Dec. 6 and continuing throughout the week. Manager Charles F. Roth reports that all the space made available to exhibitors has been sold for some weeks. A number of former exhibitors as well as some new applicants have been placed on a waiting list but it is not probable that any more space can be allocated.

BAUXITE OUTPUT REDUCED IN ARKANSAS

BECAUSE supply was running ahead of requirements, an order from the War Production Board has directed the Republic Mining & Mfg. Co. to curtail by 65 percent its output of bauxite at its mine in Saline County, Arkansas. This bauxite has been supplying the Hurricane Creek alumina plant in Arkansas operated by Alcoa, the mining company being a subsidiary of the Aluminum Co. of America. The order is to remain effective for a period of eight months and does not apply to other companies mining bauxite in that section.

Col. Gilbert I. Ross, chief of the New York Ordnance District, presents the Army Ordnance Department's Citation of Merit to Raphael L. Stern, chemical superintendent of Hercules Powder Co.'s plant at Parlin, N. J. Through Mr. Stern's efforts, woodpulp was made adaptable for the manufacture of smokeless powder and this made it possible to enlarge production, despite a shortage of cotton linters, as well as to greatly reduce production costs.

"E" AND "M" AWARDS

FOR PRODUCTION EXCELLENCE

Among the companies which, in the past month, have been awarded the honorary Navy "E" and joint Army and Navy "E" burgee for exceeding all production expectations in view of the facilities at their command, are included the chemical and explosives plants, the chemical process industries and the chemical engineering equipment concerns listed below. Other process and equipment plants will be mentioned in these columns as the awards are presented to the individual plants.

American Steel Package Co., Defiance, Ohio.
American Viscose Corp., Fort Royal, Va.
Associated Foundries and Manufacturers, Inc., New York, N. Y.
Bendix Aviation Corp., Owosso, Mich.
Bendix-Westinghouse Automotive Airbrake Co., Elyria, Ohio.
Burlington Mills, Inc., Burlington, Wis.
Callite Tungsten Corp., Union City, N. J.
Carboloy Co., Inc., Detroit.
Cayasler Mfg. Corp., Buffalo.
Champion Spark Plug Co., Toledo.
Chicago Transformer Corp., Chicago.
Chromium Corp. of America, Cleveland.
The Creamery Package Mfg. Co., Fort Atkinson, Minn.
Criterion Machine Works, Beverly Hills, Calif.
Crown Fastener Corp., Warren, R. I.
Cushman Motor Works, Lincoln, Nebr.
Dellenbarger Machine Co., Philadelphia.
Douglas Aircraft Co., Inc., Long Branch, Calif.
R. J. Ederer Co., Chicago.
Electrical Connectors and Mfg. Co., South Milwaukee.
Electro-Motive Mfg. Co., Willimantic, Conn.
Everedy Co., Inc., Frederick, Md.
General Motors Corp., Detroit, Kansas City, Vandalia, Ohio, and Rochester, N. Y.
Haber Screw Machine Products Co., Chicago.
Hamilton Mfg. Co., Two Rivers, Wis.
Hathaway Mfg. Co., New Bedford, Mass.
Heller Bros. Co., Newcomerstown, Ohio.
Hoof Products Co., Chicago.
Hydrawmatic Machine Corp., New York.
Ilco Ordnance Corp., Bedford, Ind.
Independent Engineering Co., O'Fallon, Ill.
International Business Machine Corp., Poughkeepsie, N. Y.
Intertype Corp., Brooklyn.
Kent Metal and Chemical Works, Edgewater, N. J.
La Salle Steel Co., Hammond, Ind.
Link Belt Co., Caldwell Plant, Chicago.
Mid-West Forging and Mfg. Co., Chicago Heights.
National Enameling and Stamping Co., Milwaukee.
Neenah Paper Co., Neenah, Wis.
New England Brass Co., Taunton, Mass.
Novocol Chemical Mfg. Co., Inc., Brooklyn.
Palmetto Cotton Mills, Inc., Palmetto, Ga.
Raybestos-Manhattan, Inc., Passaic, N. J. and Bridgeport, Conn.
Remington Arms Co., Inc., Salt Lake City.
G. F. Richter Mfg. Co., Inc., Glendale, N. Y.
Scott & Williams, Inc., Laconia, N. H.
Strong, Cobb & Co., Inc., Cleveland.
Surrey Engineering Co., Long Island City.
Tulsa Winch Mfg. Co., Tulsa, Okla.

MARITIME COMMISSION "M" AWARDS

The following companies have been awarded the Maritime Commission's "M" pennant, the maritime victory flag, and labor merit badges for the workers for excellence in production:

Baltimore Copper Paint Co., Baltimore.
Bethlehem Steel Co., Bethlehem, Pa.
DeVoe & Raynolds Co., Inc., New York.
Inland Steel Co., Chicago.
Jones & Laughlin Steel Corp., Pittsburgh.
Republic Steel Corp., Cleveland.
Worthington Pump and Machinery Corp., Harrison, N. J.
Youngstown Sheet and Tube Co., Youngstown, Ohio.

WASHINGTON NEWS

Changing rules in the middle of the game is the privilege and practice of Government. The chemical industry is being confronted by three changes to be brought about by contract renegotiation, termination of contracts and disposal of surplus government-owned material either raw or processed. Strenuous efforts are being made to throw out renegotiation. Major result appears to be that industry has sold the idea that Government must help in some way to ease the burden of reconversion when the war ends.

Abrupt termination of contracts either at the end of the war or as a result of changing war requirements could catch industry with a great amount of capital tied up in raw material and work in process both in major plants and in the plants of subcontractors. Provision for this contingency has been made recently by joint action of both services, the Maritime Commission and the Federal Reserve Board. Basis for granting government V loans was made broader in a plan "designed to assure contractors that their working capital invested in war production will not be frozen in the event of contract terminations. Interest on loans guaranteed under the new program will be assumed by the Government upon termination of contracts as under present Regulation V guarantees. "This decision to broaden industrial credit facilities was reached with a view to preventing any lag in war production, which might be caused by fear on the part of contractors that their capital would be tied up as contracts are cancelled in response to swiftly changing war requirements."

The government announcement goes on to say, "The broadening of the plan will enable contractors to obtain the use of most of their own working capital immediately upon termination of their contracts. Banks will be enabled to make such advances at once, and with a minimum of complications."

Most serious threat to the domestic economy is the possible dumping of huge government-owned stockpiles after the war. Industry might be told to close down while the Government moves into the picture selling great quantities of material at low cost which could easily ruin the market for many years. Congress is ready to grapple with this touchy problem. A bill passed by the House some time ago would give the privilege of disposal of surpluses to the Army, the Navy and the Treasury Procurement Division for the duration only. It is now done under authority of an executive order.

There is a bill introduced by Congressman Wright Patman to create a surplus property custodian to handle the sale of government-owned surplus equipment and material. Senator Scrugham's stockpile bill also has a bearing on the subject. There seems to be agreement in Washington that the domestic economy must be protected. At this point agreement ceases and the sword is left hanging over industry's head.

MAINTENANCE ORDER

Terms of P-89 were broadened by an amendment to the order issued the last of September permitting the use of MRO material for the rearrangement of existing installations while the requirements for filing reports and applications for quarterly quotas were simplified. Liberalization of the order to permit rearrangement was done by adding the following self-explanatory sentence to paragraph (a) (8), which allows use of material for maintenance, repair and operating supplies to the value of $500 for minor capital additions: "In the case of rearrangement of an existing installation, or in the case of adaptation of an existing installation to a different process, only the material added to the existing installation need be considered in computing the $500.

Paragraph (a) (9) which formerly listed the items not included as maintenance, repair and operating supplies was revoked. It was replaced by a new paragraph (g) (3) which says that the lists in priority Regulation No. 3 will be used instead. The next change, which occurs in paragraphs (c) (1) and (2), says that in spite of the amendment members of the chemical industry will finish the year on the basis of quotas already assigned for the fourth quarter on form WPB 1765.

Future procedure is set up in the next paragraph, (d) (1). Requirement for future filing of application for quarterly quotas is eliminated which will accomplish a very welcome saving in paper work. Instead of the quarterly filing, the industry is told that 1944 quotas will equal 1943 purchases figured on an annual basis. This means that quarterly accounting may be dispensed with if desired. Generally speaking the rating of AA-1 is given to purchases made under the terms of P-89 for 1944.

Evidence of the easier position of aluminum is found in another change. The small order exemption for the purchase of aluminum in any quarter has been raised from 100 lb. to 500 lb.

When special applications for priority assistance are made in the future, operators will find two changes in the list of information that must accompany the request. To item 6 which read "Amount of such material (or equivalent substitute) in inventory" has been added the phrase "and, in the case of processing equipment the number of units in service." Item 11 has been changed to read, "Nature of the emergency." These changes were made in an effort to secure more useful information.

Under the previous version of P-89, producers applying for a special rating for containers were instructed merely to write to the Chemical Packaging Section. The amendment lays down the procedure to be followed and the information that should accompany the request. The new procedure should save at least one round of letters, possibly even more.

The last change of importance has to do with what is a chemical producer. Producers are not producers as far as P-89 is concerned unless they have received a serial number. This is emphasized again in the amendment by an addition to paragraph (j) which reads, "For the purpose of the order a producer remains a producer from the time a serial number is granted to him until the time when the serial number is expressly revoked by the War Production Board."

GOVERNMENT STOCKPILES

Government-owned stockpiles of chemicals are down generally speaking. The exceptions are alcohol, for which the raw material is imported, and other items that must be brought in from foreign countries. Largest accumulations are in the area of resinous materials. Benzene, now on hand in quantity, can go into gasoline. Cotton linters have already been dumped on the market with some upsetting results. Shellac, which is held in considerable quantity by the Government, is an imported material. Fats and oils certainly are not in as bad shape as the government officials would try to lead the public to believe, otherwise some of the less important users would have been cut off sharply by this time.

Stockpiles of some of the metals used in ferrous alloys and also by the chemical industry are beginning to approach burdensome proportions. But here again the supply is coming in from overseas and in some cases there are definite indications that diplomatic considerations will require continuing importations in quantity. Chromium might be an example. Cadmium along with zinc is in very short supply and from Washington the position of lead appears to be deteriorating rapidly. Cadmium has been put under stricter control with uses of the small supply limited to the more important items of military equipment.

During the past three or four years the use pattern for cadmium has changed. Previously about 40 percent of the annual consumption was used for electroplating with about 20 percent used in solder and a like amount in pigments. Today approximately 92 percent is used for electroplating. During the period when use of cadmium in electroplating has increased so rapidly, its use in bearings, in pigments and in solder has decreased a very marked degree. Use of cadmium in bearings is now showing a tendency to increase, which is the

direct result of the necessity for replacement and repair of old units. The metal for bearings will come from the supply previously allocated for use in pigments and solders. Outlook for the future is not bright for those uses low in the urgency scale. As the production of war material increases, the least critical uses will be denied. Future amendments to the order controlling the use of cadmium will merely indicate a redistribution of the available supply.

CRITICAL LABOR AREAS

On October 1, deadline for the drafting of fathers, WMC announced that critical labor areas had been increased from 59 to 71. The labor shortage industrial areas have largely been mistakes of taking labor to industry rather than bringing industry to the labor. The airplane industry on the West Coast, which is now responsible for producing 50 percent of our plane requirements, is one of the areas in which the manpower shortage is most acute.

The Baruch report on manpower conditions forced the establishment of what is now called the West Coast Plan for the distribution of labor in that critical area. Actually it is the Buffalo Plan, which places control of hiring in the hands of the United States Employment Service. All hiring is done through USES, which refers male labor to plants according to the position of each plant on a secret priority schedule set up by a labor requirements board functioning in each labor shortage area.

By this plan labor is moved within the labor shortage area to those plants where the labor is of greatest use in the war effort. It is moved from plants of lower priority to plants of higher priority with the utilization of each workman's highest skill, a factor governing where he is placed.

Some criticism of this plan has reached Washington. Management dislikes the possibility of contract cancellation if the necessary labor is not available in the area. Objections from labor are that they fear rates of pay will be scaled down as men are moved arbitrarily from plant to plant. It may also be possible that labor will be drained out of some industry where there is one union into another industry and another union. High labor officials in Washington have privately expressed their wholehearted support of the plan, and high officials of the War Production Board believe that the possible transfer of contracts will not dislocate industry in any degree.

Tying into the whole program for relieving the manpower problem in the shortage areas was the reissuing of Directive 2, Amended, covering the placing of war contracts, by Chairman Donald Nelson of the War Production Board. Present policy is to avoid the contracting for all production in areas in which labor shortages are known to exist and "regardless of any other considerations, no contract requiring increases in employment shall be placed in the West Coast region, or in any other region to which a program similar to the West Coast manpower program may hereafter be applied, without the prior approval of the Chairman of the War Production Board . . ."

Officials agree that the successful application of the plan is all that stands between the country and a national service act, which could be a tremendous political weapon against both labor and management.

Congress came back to a great hue and cry over the Wheeler bill to defer the drafting of pre-Pearl Harbor fathers. This bill actually put Congress on the spot because it made necessary a choice between taking fathers or taking key men from industry.

When the Selective Service Act was passed in 1940, there was long debate in Congress over its provisions. At that time the order in which men would be called was established with fathers coming last. There has been no change in the pattern which was established when the Selective Service Act was under consideration.

The great hullabaloo will not prevent drafting of fathers, but it may influence decisions of local boards. It may also smoke out some thousands of men eligible for military service who are holding government jobs alleged to be essential.

FATS AND OILS SUPPLY

A 28 percent increase in soap production for civilian use is to be inaugurated according to a War Food Administration announcement made in late September. WFA went on to say, "The increase in soap output will be made possible by improved shipping conditions which permit the importing of more fats and oils; by increased production of domestic animal fats and vegetable oils; and by the more general use of rosin and other soap materials as substitutes for fats."

WFA expects that additional supplies of fats and oils will provide for a 19 percent increase in the civilian soap supply. Use of rosin and other fat extenders will stretch the supply another 9 percent.

Inventories of glycerine have also improved along with the shipping situation with the result that small quantities have been released for civilian uses. Definite inventory requirements have been established by WFA. Excess quantities are being released even though small. The small amount available is being shared by manufacturers of dentifrices, flavors, shaving cream, adhesives, tobacco, shortenings, crown caps and protective coatings.

Fats and oils being imported are coming from Africa and are replacing imports that formerly reached this country from the Far East. The question is immediately raised whether far eastern sources will be able to recover their former importance in the American market in the post war period. African sources are much closer to markets in this country than the Philippine Islands or any of the other islands of the East Indies.

Interchangeability of sulphonated oils permits users to substitute oils that are plentiful for those in short supply. Discussions to this end between the manufacturers and War Food Administration will result in specific allocations for sulphonation on the basis of absolute necessity. As a matter of self protection users of sulphonated oils should be prepared to use any one of the group of interchangeable oils on short notice.

ALCOHOL FROM MOLASSES

Alcohol in quantity is again to be made from molasses. The War Food Administrator and the Department of Agriculture have informed the Rubber Director that much less grain for alcohol to supply the rubber program can be made available because of other requirements. Since the rubber program will use more alcohol next year than this year, government authorities have turned to molasses as an alternate raw material.

The total year's molasses requirements have been set at 375,000,000 gallons, of which 300,000,000 gallons will be brought in from the Caribbean area. Fifteen tankers authorized for this service will deliver approximately 25,000,000 gallons of molasses a month to the eastern seaboard where it will be processed in plants which in the past have always used molasses as their raw material for the manufacture of alcohol. This means a reconversion of the plants and an abandonment of the use of grain for the manufacture of alcohol in much of the eastern area.

Some fear has been expressed in Puerto Rico that the taking of molasses will interfere in the production of feed grade yeast. It can be definitely stated that these fears are unfounded.

The first of October the negotiations for the purchase of the required amount encountered a stumbling block in the question of price. Conversations recessed temporarily. In the meantime, the United States owns nearly 100,000,000 gallons to which title was secured in payment for relief in the Islands. This is approximately four months' supply, which is ample to keep alcohol production at capacity until the negotiations can be successfully consummated.

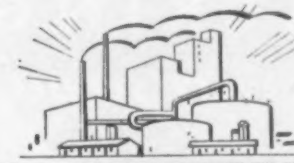
Rules under which the National War Labor Board will conduct its hearings and circumstances under which it will review awards made by an arbitrator were announced last month. Hearings are "public" according to provisions of the War Labor Disputes Act, meaning that they are open to any interested person including the representatives of the press. Hearings may be conducted informally the rules state. Parties to the dispute will be given reasonable advance notice which should contain a statement of issues when it is possible to do so. Parties to the dispute have the right to request issuance of a subpoena to secure relevant evidence. The request must be accompanied by an explanation of the nature of the evidence and why it cannot be obtained without a subpoena.

Policy of the board for review of arbitration awards covers conditions in non-wage issues and when a wage dispute is involved. Texts of both statements are available on request to the National War Labor Board.

Questions we are often asked

ABOUT GLASS-LINED STEEL

No. 2—*What is the real resistivity of Pfaudler Glass enamels?*



"Pfaudler glass (Silica base) enamels are resistant to all acids (except HF) at any concentration and at temperatures up to approximately 600° F.," states P. S. Barnes, Manager of Chemical Sales for The Pfaudler Company.

To illustrate the real resistivity of Pfaudler glasses, we suggest that you study the tests we recently conducted on this point. Certain of our cover glasses, were formed into irregular rectangular shapes of solid glass, and were subjected to the action of various acids for a definite period of time, and under the conditions outlined. It should be understood that the following figures indicate a measurement of resistivity of Pfaudler glass rather than the actual life of glass-lined equipment.

The results were as follows:

A. Dilute lactic acid boiling for 720 hours: The loss of weight on the immersed sample of our glass indicated by exact measurements that the approximate life of the glass would be 62.2 years.

B. Dilute phosphoric acid boiling for 720 hours:
The loss of weight on the immersed sample of our glass indicated by exact measurements that the approximate life of the glass would be 42.8 years.

C. Distilled water boiling for 720 hours: The loss of weight on the immersed sample of our glass indicated by exact measurements that the approximate life of the glass would be 244 years.

These figures are rather startling when related to the practical results obtained with any type of corrosion resistant equipment, but we give you the examples to show that the glass itself does not have limited life in the presence of many acids.

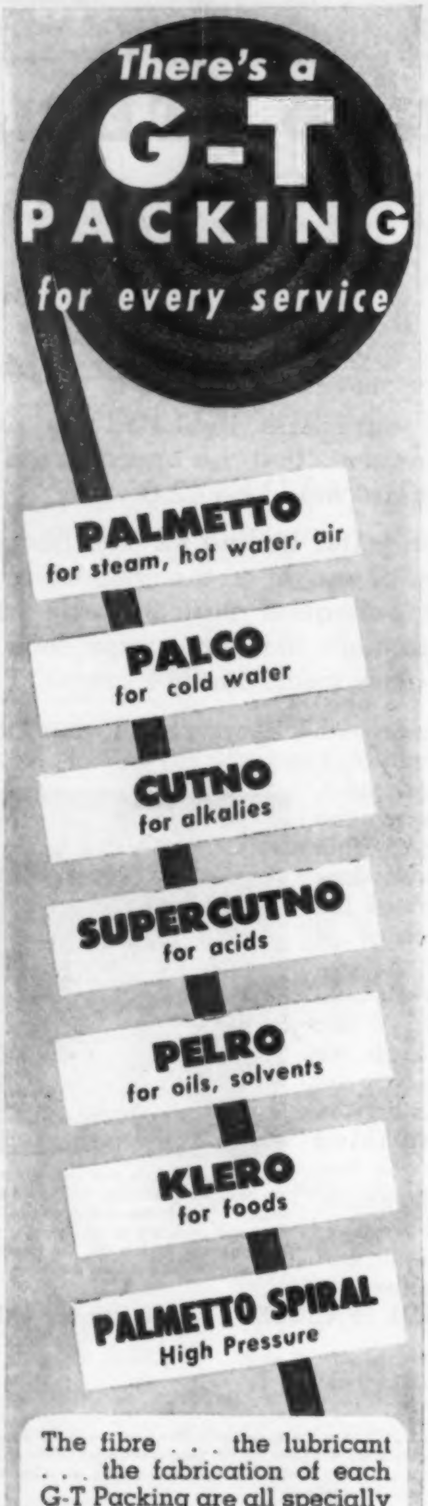
We test each individual smelt of our glasses which we manufacture ourselves by boiling in HCl an assembled combination of test dishes and the attack, if any, of the HCl—both in the liquid and vapor phases—is measured. THE PFAUDLER CO., Rochester 4, N. Y.

Unending research and constant testing are basic with Pfaudler. Illustrated here is impact tester to determine enamel hardness and resistivity to mechanical shock. The operator adjusts the arc to produce different degrees of inch pounds.

Widely used for making pharmaceutical preparations, Pfaudler glass-lined steel keeps products free from dissolved metals that might impair potency.

Note the number and position of the openings in this reaction kettle equipped with electrical heating units to derive 600°F. temperature for polymerization of linseed oil. Our engineers are at your service to design glass-lined steel units that facilitate your production.

THE PFAUDLER COMPANY, ROCHESTER 4, NEW YORK



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Assn. of Consulting Management Engineers. Exec. Sec., N. W. Barnes, 30 Madison Ave., New York 17, N. Y.

Assn. of Official Agricultural Chemists. Sec., W. W. Skinner, Box 540, Benjamin Franklin Station, Washington 4, D. C.

B

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Bureau of Raw Materials for American Vegetable Oils & Fats Industries. Sec., J. B. Gordon, 1251 Nat'l Press Bldg., Washington 4, D. C.

Burlap & Jute Assn., The. Sec., R. S. Carraway, 133 W. 21st St., New York 11, N. Y.

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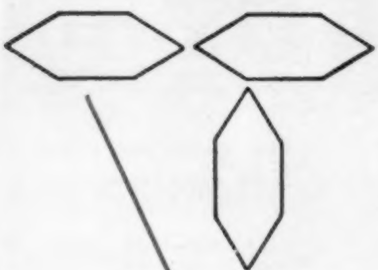

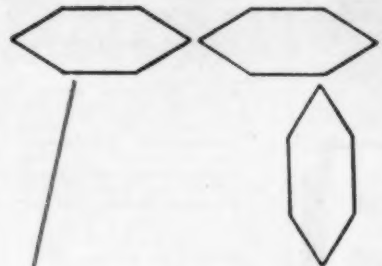

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READERS' VIEWS AND COMMENTS

ALCOHOL FROM SULPHITE LIQUOR

To the Editor of Chem. & Met.:

Sir:—In your report "Industrial Alcohol for War and Postwar" which appeared in your August issue, there are several erroneous statements relating to the production of alcohol from waste liquors of sulphite pulp operations. Your report states that the practical yield is 12 gal. of alcohol per ton of pulp manufactured. Actually, with recovery of sulphite liquor from the blow pits, more than 18 gal. of alcohol can be obtained for each ton of pulp.

You estimate that a mill with a daily capacity of 175 tons of pulp or more can support an alcohol plant of economic size. This figure is based on the recovery of 12 gal. of alcohol per ton of pulp, but since the practicable recovery is more than 18 gal. per ton of pulp, it is obvious that the economic size of the pulp mill will be much less 175 tons daily production. It is my opinion that a mill of 100-ton capacity could operate an alcohol plant successfully.

The above figures are based on actual operations at the alcohol plant of the Ontario Paper Co. Ltd., in Thorold, Canada. This plant, officially opened in June of this year, is the first and only such alcohol plant operating successfully on the North American continent.

Average fermentation of sulphite liquor at the Thorold plant is about 20 hours, instead of 24 hours as stated in your article, and the 70-90 hours required in the Swedish method.

M. M. Rosten

Consulting Engineer
Ontario Paper Co. Ltd.
Thorold, Ontario

POSTWAR EDUCATION

To the Editor of Chem. & Met.:

Sir:—This letter is prompted by your August editorial, "Our War Lesson No. 1," which urged that some of the present contracts with educational institutions should be continued in order to train young men in the science and technology of war.

While it is admitted that the curricula of the service schools, West Point and Annapolis, are excellent and that the graduates have a good four year education and training, their further studies are generally limited to the experiences gained in the services. This is substantially akin to a graduate from an engineering school continuing his studies by his experiences in industry. We recognize that this does not provide sufficient opportunity and facilities for the research and development work needed for our normal peace time pursuits and many men and women continue their work in postgraduate study.

Since war has developed into the use of all kinds of scientific devices by both Army and Navy, and particularly in the air branches, would it be presumptuous to suggest that the armed forces should have a graduate school to which would be assigned certain of the personnel of the Army, Navy and Air Forces, who would be qualified for postgraduate work.

Due to the confidential nature of some of the work, it might be advisable to have a separate institution, similar to West Point and Annapolis, in which postgraduate study and confidential or secret research and development work could be prosecuted.

Some portion, and possibly a large portion of the postgraduate study, and certain items of research might better be done in established engineering schools, and thus provide broad contact with a variety of established and competent teachers and research men. No doubt this could be done on a contract basis between the suggested graduate school of the armed forces and the several engineering schools.

This suggested graduate school of the armed forces might be limited by law to graduate study in the military, naval and air sciences directly concerned with the armed forces. Likewise, research and development work probably should be limited by law to the procurement of information deemed valuable for the armed forces. I would be opposed to the use of such a graduate school and its facilities for any purpose other than the protection of our country by the armed forces. I would be opposed to its use for other governmental activities.

J. L. Bennett

Chemical Engineer
Wilmington, Del.

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ALL LIQUIDS
ALL METALS

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FILTERS
For Light Liquids

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Write for Details

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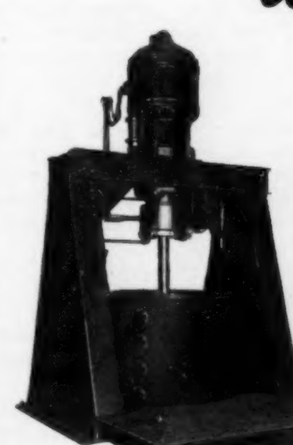

❶ *Exclusive Fletcher "Centroid" speed control automatically maintains a safe unloading speed of approximately 50 R.P.M. Operator can give undivided attention to handling the unloader.*

❷ *A wood buffer ring attached to the inside of the curb base prevents basket from striking curb, even with badly unbalanced loads.*

\+

❶ *Sight feed lubrication is arranged so that the operator can always see the oil flowing to the bearings. A guarantee of cool, free-running bearings and low cost operation.*

❷ *Tangential outlet assists removal of liquor from curb. Inspection door gives access to outside of basket.*

=

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❹ *features . . . but they total to the 5 advantages of Speed—Safety—Convenience—Low-Cost Operation—Durability. Fletcher engineered improvements give you these and many more. Complete details in our new catalog, free upon request. Write us on your letterhead.*

Engineered by the FLETCHER WORKS, *Glenwood Ave. & 2nd St., Phila. 40, Pa.*

INTERPRETING WASHINGTON

CONTENTS

This installment covers orders, rules and regulations issued by the War Production Board and the Office of Price Administration during September, 1943. Copies of each item interpreted may be obtained by writing to the appropriate federal agency.

MINERAL WOOL INSULATION

MPR-188 was amended by OPA on September 15 permitting manufacturers of mineral wool insulation to use the special "national or general shortage" provision for the adjustment of maximum prices. The new provision permits the granting of relief to cover total manufacturing costs to (1) manufacturers who are unable to maintain or expand production under existing maximum prices wherever there is a general shortage and the production of each producer is needed, or (2) where the loss of the seller's production would result in higher consumer prices.

USED PRESSURE VESSELS

MPR-465 was issued on September 13 by OPA listing more than 2,600 dollars-and-cents prices for 1,300 sizes and combinations of used pressure vessels and used inclosed atmospheric pressure vessels. The specific maximums listed in this Regulation generally reflect the prices in effect on March 31, 1942, and continue the price level set previously by MPR-136. New vessels continue to be priced under the maximums prescribed by Regulation 136. The new maximum prices for "reconditioned and guaranteed" vessels, regardless of age, are based upon 85 percent of maximum prices for sale of the vessel when it was new. The maximum prices for used vessels which cannot qualify as reconditioned and guaranteed are based upon 55 percent of the ceiling price for the vessel when it was new. The term, "pressure vessel", means any cylindrical vessel of black steel which is capable of holding any liquid or gas at a higher pressure than atmospheric. "Inclosed atmospheric pressure vessels" refers to those capable of holding any liquid or gas at pressures not in excess of atmospheric pressure.

Before a dealer may sell a used vessel as "reconditioned and guaranteed", the vessel must be thoroughly cleaned inside and outside by the use of hot alkali, live steam, sandblasting or by any other machine or hand applied abrasive method, and must be as free from leakage as a new vessel. Re-machining and re-threading of stripped or cross threaded openings or the use of flanges or fittings when this is impractical, is also required, as are new gaskets to replace worn gaskets and painting of outside surfaces with at least one prime coat and one oil paint coat or equivalent.

ASBESTOS-CEMENT BUILDING MATERIALS

MPR-466 was issued by OPA on September 13, establishing maximum dollars-and-cents ceilings for sales of asbestos-cement building materials by any seller from a factory. Prices will remain approximately at the current level for three of the four classes of building materials made from asbestos-cement: (1) roofing and siding shingles; (2) lumber, flat sheets, sheathing and wallboard and (3) flexible wallboard and decorative flexible wallboard which are used for interior construction. For the fourth material, corrugated sheets, a reduction in price eliminating the 10 percent increase put into effect by most of the industry in the spring of 1941, was ordered.

TEXTILE BAGS

Conservation order M-221 was amended on September 11 by WPB to permit the purchase of new burlap bags for packing salts and to increase purchase quotas for several non-agricultural products including petroleum waxes, stearic acid and salt. The quotas are now 100 percent of 1941 acceptances. In addition, the amendment relaxes the prohibition against selling any used raw-sugar bags except for further re-use in packing sugar. The prohibition now applies only to No. 1 burlap bags, as defined in the Order.

SCALES, BALANCES AND WEIGHTS

Limitation Order L-190 was amended by WPB on September 24, imposing comprehensive standardization measures on production of large capacity scales used primarily for commercial purposes. Among other restrictions, Schedule IV restricts the fabrication or assembly of portable beam scales to five models ranging in capacity from 1,000 lb. to 4,000 lb., and otherwise closely described in the Order. Schedule VI limits the fabrication or assembly of portable dial scales to those having platforms measuring 21 in. adjacent to the column by not less than 29 in. nor more than 30 in. Schedule VII restricts the production of dials. Schedule VIII prohibits the production of self-contained floor scales, except scales with skeleton frame, wood box or fulcrum stand construction. Schedule IX prohibits the production of built-in floor scales, except scales with wood platforms.

SEAMLESS HEAT EXCHANGER TUBING

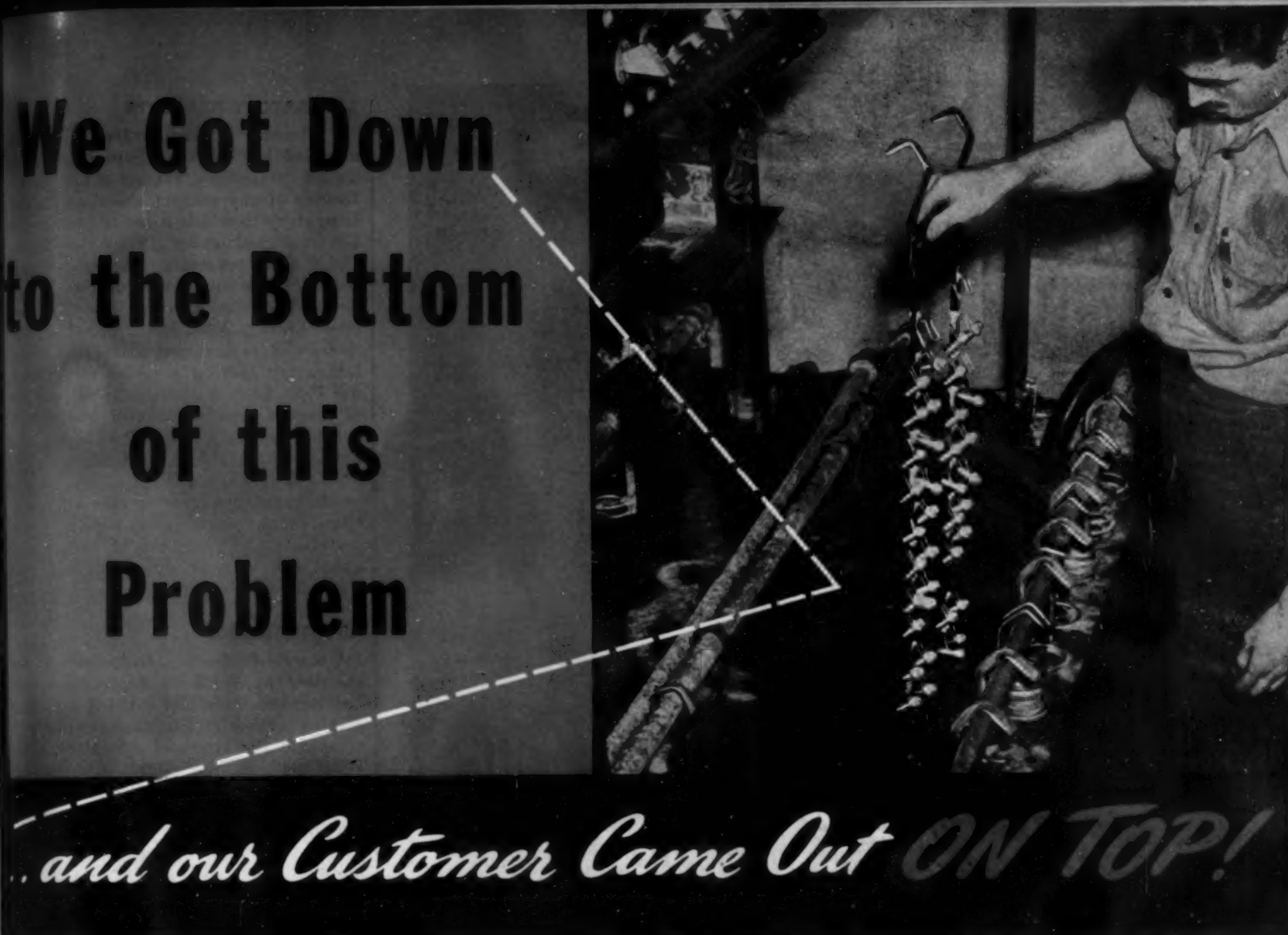
Limitation Order L-126 was amended by WPB on September 28, extending the permission for use of seamless steel tubing to Jan. 1, 1944. Permission was originally given to use seamless steel tubing in the production of finned coils or tube assemblies where the tubing is expanded to obtain the bond between tubing and fins, or where the tubing is $\frac{5}{8}$ in. O.D. size or larger. As before, the extension is granted on the basis that a satisfactory welded steel tubing as a substitute for seamless and copper tubing is not yet available.

STRUCTURAL STEEL SHAPES

Limitation Order L-211, Schedule 4, as amended by WPB on September 2, eliminates shapes under 3 in. from the definition of "structural steel shapes." These are considered "bar size" shapes and are no longer part of this schedule. Another change in the schedule is the substitution of April 1, 1943 specifications as to approved sizes and shapes in place of the earlier specifications of May 11, 1942. Another paragraph has been added to provide for delivery of stock shapes when a purchase order contains no definite specification.

METHYL SALICYLATE

MPR-353 was amended on September 24 by OPA providing specific cents-per-pound ceiling prices for methyl salicylate. Methyl salicylate obtained by distillation from birch and wintergreen is not covered by the amendment. The producers' prices specified in the amendment are the same as those existing since 1938, while resellers' prices are based on producers and primary distributors prices plus customary mark-ups. The highest resale price under the amendment is 92 cents per pound, established for sales of quarter pound containers when sold in lots of less than 25 lb. Sales at retail are not covered by this amendment and remain under the GMPR control.



THE PROBLEM: A customer of our Baker & Adamson Division was lead plating the old, time-honored way—mixing up Hydrofluoric Acid, Lead Carbonate and Boric Acid. Mixing was hazardous, "messy," and time-consuming. Could Baker & Adamson offer a *better* method?

THE ANSWER: After studying the problem, Baker & Adamson suggested..."Why can't we manufacture your finished solution—furnish it in prepared form?" "Fine," said the customer, and that day a new product was added to the Baker & Adamson line. It was *Lead Fluoborate.*

This material is now available to all platers and manufacturers. It is successfully replacing Cadmium and Zinc in many applications. Further, due to the ease of plating with Lead Fluoborate, lead plating is finding a growing list of applications for which it is particularly suited ... such as airplane bearings, battery parts, etc.

THE POINT: This is only one example of how our Baker & Adamson Division is furnishing "special" chemicals to industry in *finished* form. If *your* industrial processes require such chemicals in commercial quantities, let us discuss your problem in terms of the end chemical required.

The Baker & Adamson organization is *regularly* helping manufacturers with such problems and *relieving them of unnecessary chemical manufacturing responsibility.* Write or phone us today. We will work with you directly throughout—and *confidential problems will be handled in the strictest confidence. No obligation, of course!*

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When you put on the heat
B-H MONO-BLOCK
Can Take It

You can't beat Baldwin-Hill Mono-Block Insulation for performance when it comes to boilers, engines, ovens, furnaces, and other high-temperature installations. Here is a felted block insulation that is effective over the entire temperature range up to 1700° F. in contrast with most other molded type insulation blocks that are made for either high or normal temperatures —not both.

B-H Mono-Block is felted by a patented process from *black* rock-wool that refuses to break down under much greater heat than many other types of insulation can stand. It is moisture-resistant and will not disintegrate under humid conditions. Being exceptionally low in conductivity, it does a better job of saving steam costs.

B-H Mono-Block is easy to install. It is sufficiently rigid to support its own weight, and yet yielding enough to absorb surface irregularities. Send for full information and generous sample.

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LABORATORY REAGENTS

Preference Rating Order P-135 was amended by WPB on September 28 to assign preference rating AA-1 to deliveries of any reagent chemicals to any laboratory to which a serial number has been assigned under Preference Rating Order P-43, governing laboratory equipment, and to any laboratory owned and operated by the Army or Navy. Preference Rating AA-2 is assigned to deliveries of any reagent chemicals to any laboratory lacking a serial number under P-43, or to a distributor or producer of reagent chemicals.

Supplementary Order P-135a was also amended by WPB on September 28, providing that when a WPB Order exempts small quantities from specific authorization requirements and requires only certification, 10 percent of these small quantities may be delivered and used without certification.

DIPHENYLAMINE

General Preference Order M-75 was amended by WPB on September 29 to become Allocation Order M-75. Suppliers seeking authorization to make delivery must file the standard allocation Form WPB-2947 on the 20th of the month prior to the month of delivery. Consumers requiring 5,000 lb. or more in any one month must file Form WPB-2945 on the 10th of the month preceding delivery. Certificates of intended use are required of customers using from 50 to 5,000 lb. per month. Exemption from authorization is provided for use or acceptance of delivery of less than 50 lb. per month.

ACETONE AND DIACETONE

Allocation Order M-352 was issued by WPB on September 28, placing acetone and diacetone under allocation control. Prospective purchasers desiring to obtain delivery in any month from all sources of more than 1,750 lb. of acetone or more than 2,075 lb. of diacetone, must use Form WPB-2945 in accordance with instructions in the Order. For smaller amounts a method of certification is provided in the Order. Suppliers seeking to make delivery must use Form WPB-2947, as instructed in the Order.

MALEIC ANHYDRIDE AND ACID

Conservation Order M-214 was amended on September 24 by WPB, placing maleic anhydride and maleic acid under allocation control along with phthalic anhydride, previously placed under control. The standard chemicals Forms WPB-2945 and WPB-2946 should be used for authorization to deliver or accept delivery of these chemicals. The exemption from authorization provides for use or acceptance of delivery of not more than 700 lb. of phthalic anhydride, 500 lb. of maleic anhydride and 200 lb. of maleic acid in any one month. Provision is made for use of stocks on hand pending receipt of material allocated for a particular purpose, but quantities withdrawn from inventory must be replaced on receipt of the allocated material.

LINSEED REPLACEMENT OIL

Revised Supplementary Regulation No. 14 was amended on September 25 by OPA to establish maximum prices for linseed replacement oil. Dollars-and-cents ceiling prices were established for both manufacturers and resellers in the case of replacement oil conforming to federal specifications TT-0-371, which is used as a substitute for the 100 percent linseed oil as required by WPB Order M-322.

SUBSTITUTE RUBBER

MPR-406 was amended by OPA on September 20 bringing under control substitute rubber in the form of raw materials. The amendment applies to substances which are made in whole or in part by a chemical process or from natural gums resins or oils, and which sufficiently resemble natural or synthetic rubbers to replace them for particular uses. It does not apply to finished objects or parts made of substitute rubber. Previously, substitute rubber was covered by the General Maximum Price Regulation.

THERMOPLASTICS

General Preference Order M-154 was amended on September 14 by WPB to include acrylic resins, bringing their use in line with that of other thermoplastics under control.

Allocation Order M-260 was also amended substituting Form PD-602 for Forms PD-600 and PD-601. In addition, definitions are limited to first grade materials only, cast sheet having an area of less than 3 sq.ft. is exempted from allocation control, and the small order exemptions are broadened considerably. The main purpose of this amendment is to reduce the work of administration of the Order.

POTASSIUM CHLORATE

Revised Supplementary Regulation No. 14 was amended on September 15 by OPA establishing temporary ceilings for potassium chlorate produced and sold by new manufacturers. Only those manufacturers who before January 1, 1941 were not producing potassium chlorate are covered by the new ceilings which range from 10¾ cents per pound for contract sales of 20 tons or more down to 12 cents per pound for sales of less than a ton. The ceilings will remain in force for at least six months so that OPA can review cost experiences submitted by these manufacturers before February 1, 1944, to determine if their prices can be reduced to the level set for the few producers who were engaged in prewar production.

CHLORINATED REFRIGERANTS

Conservation Order M-28 was amended on September 7 by WPB tightening control over the chlorinated hydrocarbon refrigerant, "Freon." The Order as amended requires certification of purchase orders for Freon by users to the effect that it is needed for immediate use, whereas previously the certification

FULLER-KINYON SYSTEM

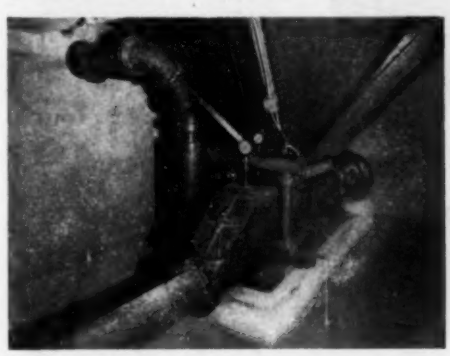
UNLOADS HOPPER-BOTTOM CARS AND CONVEYS TO BARGES

• • •

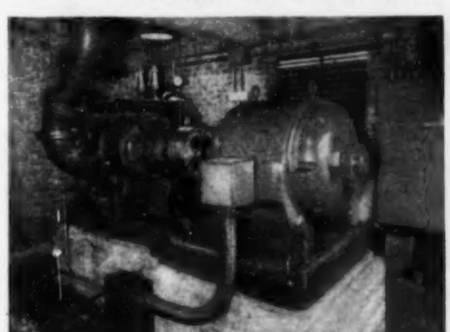
FULLER ROTARY COMPRESSOR

FURNISHES AIR FOR THIS CONVEYING SYSTEM

Hopper-bottom, bulk-cement car over pit and Fuller-Kinyon Pump.



Fuller-Kinyon Stationary Pump in pit underneath hopper-bottom car.



Fuller Rotary Single-stage Compressor which supplies air to Fuller-Kinyon Pump.

This efficient method of unloading and transferring bulk Portland cement from cars to barges is employed by a railroad company on the Hudson River, New York City.

Cement is received in hopper-bottom cars and discharged by gravity to a Fuller-Kinyon Stationary Pump located in a pit directly underneath the car. Cement is conveyed by the pump through a short pipe line to the edge of the dock. For ease of manipulation in loading barges, a flexible rubber hose is coupled to the end of the pipe line, this hose being swung in any direction for attaching to connections entering the hatches of the barge. Loading rate, 400 barrels per hour. A Fuller Rotary Single-stage Compressor furnishes air for this conveying system . . . air when and where needed, and at pressures to do the work most economically.

Fuller-Kinyon Systems have many applications. You too, may have a loading, unloading or transporting problem that can be solved with this system.

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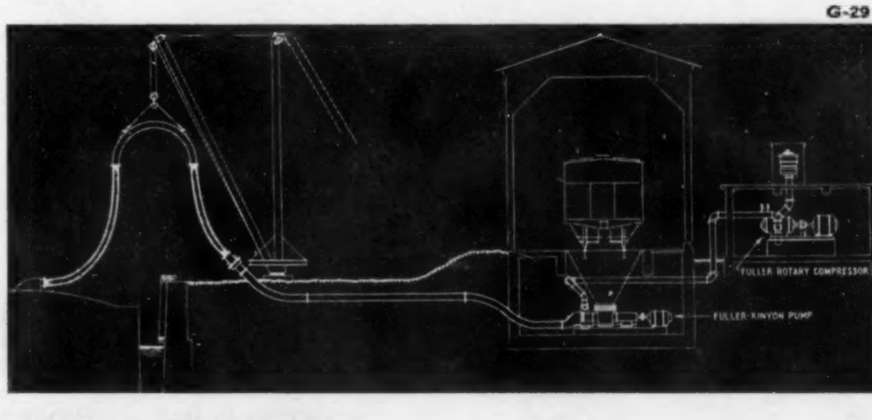
G-29



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Saves Time at every operation

Everlasting Valves are completely opened or closed with a 70-degree turn of the operating wrench . . . and the operation is easy, because the wrench gives ample leverage.

Add to this valuable time-saving feature the many other important advantages of the Everlasting Valve . . . its drop-tight seal, its self-grinding action at each motion, its provisions against damage to disc and seat, and its "everlasting" wearing qualities . . . and you have a valve that is literally unequalled for many services on process lines, emergency shut-offs, equipment outlets, boiler blow-off fire protection, etc. Write for bulletin.

EVERLASTING VALVE CO. **49 FISK ST., JERSEY CITY 5, N. J.**

Everlasting Valves

for everlasting protection

stated that the refrigerant would be needed during the following thirty days. In other words, it can be purchased now only in the case of actual breakdown. Restrictions on the purchase of Freon 12 have been revised. Freon 11 is a byproduct of Freon 12 and since its production does not lessen the output of F-12, deliveries have been exempted from specific authorization except for List B installations as outlined in the Order.

MERCURY

Conservation Order M-78 was amended by WPB on September 9 to allow the use of mercury for certain purposes which hitherto have been prohibited. A certain percentage of base period use is now allowed for film developing, treating of green lumber, preparation of vermilion, manufacture of wall switches, wood preservation, thermometers and marine anti-fouling paints. For safety and technical equipment, mercury may be used up to 100 percent of the base period total. Other products, such as mercuric fulminate for blasting caps and mercury for industrial and scientific thermometers, have their current percentages increased to 200 percent of the base period total.

CADMIUM

Conservation order M-65a was amended by WPB on September 8 to limit the military exemption of this material to those uses required by prime contracts. Certain other changes have been made in the list of prohibited and permitted uses for cadmium.

CALCIUM SILICON

General Preference Order M-20-a was revoked on September 8 by WPB. This Order allocated the material known as calcium silicon, which is used in the treatment and refining of certain steels.

PRIMARY CHROMIUM CHEMICALS

Supplementary Order M-18-b was amended on September 14 by WPB, placing primary chromium chemicals under allocation. These chemicals are used in tanning, pigment manufacture, chromic acid manufacture, surface treatment of metals, chromium plating, textile processing, chemical and dye manufacture and for metal alloys. Under the amended Order, reporting on Form PD-54 is discontinued, and instead, consumers now report on Form WPB-2945 and suppliers on WPB-2946. Exemption from authorization is provided for acceptance of delivery in any month of not more than 100 lb. of any prime chromium chemical. If certification is made to his supplier, a consumer or dealer may accept delivery without specific authorization in any month of an aggregate quantity of primary chromium chemicals not exceeding the following: 4,000 lb. of sodium bichromate or its equivalent in chromium tanning compound, 500 lb. each of sodium chromate, potassium bichromate, potassium chromate and ammonium bichromate, and 800 lb. of chromic acid.

NEW PRODUCTS AND MATERIALS

An automobile inner tube made from a vinyl type of synthetic rubber

CONTENTS

VINYL RESIN INNER TUBES

AN ELASTO-PLASTIC that is predicted will outmode rubber for use in making automobile inner tubes has been developed in the plastics research department of the Glenn L. Martin Co., it has been announced by Glenn L. Martin, president. Uses have not been fully exploited except for wartime possibilities as in tire inner tubes and surgical gloves. Marvinol is not a synthetic rubber, but a vinyl-type substance. Inner tubes can be fabricated easily, and because of the impermeability of the substance, seepage through the sidewall of the tire is entirely eliminated. Rubber gloves made for hospital, chemical and industrial use, have proven their ability to resist alkalis and acids in solution, to have longevity not obtainable with gloves made of other materials. Its developers claim it is less expensive and less complicated to produce than buna and other synthetic rubbers. Marvinol has a superior abrasion resistance, ability to withstand flexing without fatigue and is impermeable to both gases and liquids. The lack of stability of the vinyl materials when exposed to high temperatures or in strong sunlight has been overcome in Marvinol by the inclusion in the compound of a sealed-in, non-extractable plasticizer, which accounts for the reclaimability of this material. As a result this product is said to be stable, and to retain its plasticity, resiliency and flexibility in temperatures up to 250 deg. F.

VITAMIN POWDER FOR FOOD PRODUCTS

A VITAMIN A POWDER described by its manufacturers as a uniformly fine, nongranular dry powder has been put on the market by the Distillers Products Corp., Rochester, N. Y. Myva-Dry is said to have a characteristic flavor and odor typical of foods, but not of marine oils. Both flavor and odor are lost when the substance is incorporated into an edible product and the powder is uniformly dispersible when mixed with beverage powders.

OIL AND GREASE ABSORBENT AND FLOOR CLEANER

FROM the laboratories of the Fidelity Chemical Products Corp., Newark, N. J., has recently come a new oil and grease absorbent and floor cleaner Absorbo. It is listed by the Underwriters' Laboratories, Inc., as a Class 1 non-combustible absorbent for reducing fire and slipping hazards and for cleaning floors. It is said to be non-abrasive and odorless, nonpoisonous, and non-injurious to skin, clothing, or flooring. Absorbo may be readily spread by hand and used on any kind of flooring. It absorbs up to 45-50 percent of oil or grease by weight.

METHYL ACRYLATE FROM LACTIC ACID

NEW industrial uses for lactic acid are indicated by research of the U. S. Department of Agriculture. The development consists in improved methods, worked out by the Agricultural Research Administration at the Regional Research Laboratory near Philadelphia for converting lactic acid to methyl acrylate. The production of methyl acrylate from lactic acid would mean an additional outlet for farm products. Dr. Lee T. Smith and his associates at the Laboratory have found that the acrylic esters obtained in this process can be polymerized in mass, water emulsions, or in organic solvents. Because these polymers possess a wide diversity of properties, they may find outlets in the production of adhesives, adhesive tapes and impregnating and coating materials. A number of commercial manufacturers are now experimenting and working on a pilot-plant scale with the lactic-acid method of producing methyl acrylate.

MALARIA PREVENTIVE

FROM the New Jersey Agricultural Experiment Station, Rutgers University, New Brunswick, N. J., comes the chemical known only as Formula 612, which promises to be much better than quinine or similar anti-malaria drugs, for these chemicals do not cure malaria whereas the new synthetic chemical acts as a preventive against that scourge of mankind. It is an insect repeller, four to six times more lasting in its effect than any similar substitute hitherto known. Some details of its performance are still a military secret, but it is already safeguarding American soldiers and marines in areas infested with mosquitoes. The new compound is a colorless liquid. It

CHIEF CHEMIST

MEMO ★ Investigate possibilities of use of t-Butyl Hydroperoxide with special activating chemicals as polymerizing agent

Commercial *t*-BUTYL HYDROPEROXIDE

A new organic alkyl peroxide which offers extremely interesting commercial possibilities

Commercial *t*-Butyl Hydroperoxide is standardized at a concentration of 60% (10.66% available oxygen) — and appears ideally adapted for use . . .

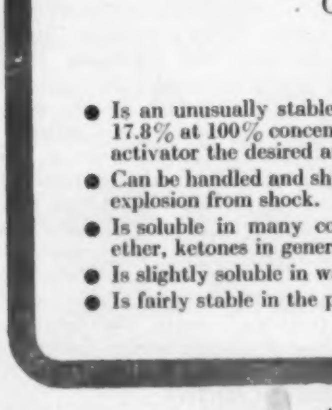
- As a catalytic agent in one or two phase polymerizations.
- As a bleaching agent for cotton, wool and other fabrics.
- As a drying accelerator in oils, paints, varnishes, etc.
- As a combustion accelerator for heavy fuel oils used in diesel engines.
- As an accelerator in the curing of synthetic resins.
- As an accelerator in the vulcanization of certain synthetic rubbers.
- As an oxidation agent for laboratory purposes.
- For numerous other uses.

t*-BUTYL HYDROPEROXIDE

$$CH_3-\underset{CH_3}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}}-O-O-H$$

- Is an unusually stable liquid with an active oxygen content of 17.8% at 100% concentration. However, by the use of the proper activator the desired amount of oxygen can be released.
- Can be handled and shipped in large quantities without danger of explosion from shock.
- Is soluble in many common organic solvents such as alcohol, ether, ketones in general, esters, aromatics and petroleums.
- Is slightly soluble in water.
- Is fairly stable in the presence of various alkalis and acids.

*U. S. PATS. 2176407 AND 2223807



★Our Laboratories and Research Staff will be glad to work with your organization and will be pleased to suggest destabilizers to be used in connection with t-Butyl Hydroperoxide specifically adapted to your present problems. For further information write today to . . .

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has no unpleasant odor and is not injurious to either persons or materials. It stands up against storage conditions and is not expensive.

WATERPROOF ADHESIVE FOR BOXES

PAPER BOXES that are said to stand submergence for 24 hr. without falling apart, are the result of the development of an adhesive by the E. I. du Pont de Nemours Co., Wilmington, Del., in their Grasselli Chemical Department. Made of from four to eight sheets of heavily sized paper laminated together with a water-soluble vinyl resin, these containers can be fashioned on standard fiberboard box machinery. Its developers add that it is noncorrosive to any metallic contents, presents no repulping difficulties and they call attention to its possibilities in air transportation because of its relative lightness and lack of bulk.

ELECTROPLATING AID

LESS THAN one ounce of a new chemical per gallon of copper electroplating solution reduces by one-third the copper required for electrotype printing plates and cuts in half the scrap resulting from the manufacture of these plates, the Electroplating Division of E. I. du Pont de Nemours & Co., Wilmington, has announced. B.C.F. Addition Agent so increases the hardness of the copper deposit that a much thinner layer will give equal service. It allows a pound of copper to cover one-third more square inches of surface. It also assures a smooth finish and speeds the plating of the electrotypes.

The agent eliminates inferior plating on the edges and corners of the printing plates. That permits a reduction in the width of safety bearers and accounts for reducing to half the copper scrap usually resulting from electrotype production.

METAL CLEANER AND DEGREASER

WATER solutions of Bionol metal cleaner and degreaser promise effective action in one to three minutes at a temperature of 140 deg. F. The chemical is a product of Biofen Laboratories, Bridgeport, Conn. It is said to be a complex organic ester containing the amide and sulphonate radicals combining the action of a powerful emulsifier and wetting agent. It is said to be non-corrosive and can be used on both steel and brass parts.

ANTI-BACTERIAL CHEMICALS

THE ISOLATION from the green cheese mold penicillin notatum, from which penicillin is extracted, of a second substance, named penicillin B, which is nearly ten times as potent a germ-killer as penicillin, has been announced. Penicillin B, isolated by a group of research workers at St. Louis University, kills bacteria in dilutions as high as 1,000,000,000 to 1. Unfortunately, it is even more rare than the original penicillin. The new germ killing chemicals belong to a chemical group known as acridines, composed of three benzene rings joined together and containing one atom of nitrogen in each ring. The nitrogen

atom at the lower end of the center ring gives this group a characteristic color. Penicillin B has been found to contain an important oxygen carrying group. It acts in exactly the opposite manner from that of the acridines. Instead of depriving bacteria of oxygen it surrounds them with too much oxygen in the form of hydrogen peroxide. This results in literally burning the bacteria alive.

DETERGENT TYPE LUBRICATING OIL

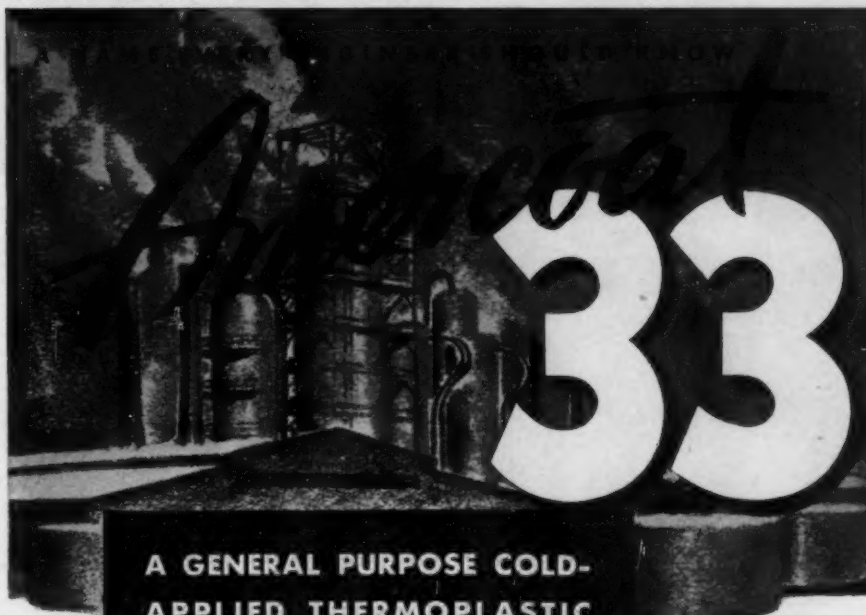
DEVELOPMENT of a new detergent type lubricating oil which will reduce wear and assure engine cleanness and oil stability for low speed diesel engines is announced by Standard Oil Co. of Indiana, Chicago, Ill. Many engines give clean operation with conventional oils, but where dirty operation cannot be corrected by mechanical adjustment, the new detergent type lubricating oil can be used, according to Standard Oil engineers. The new oil will thus prevent ring-sticking, piston-scuffing and excessive sludge and gum deposits. The detergency results from the use of an additive which is both a detergent and an oxidation inhibitor.

When a lubricant without detergency is used, carbon and other products of oxidation, as well as dirt, stick to each other and to engine parts. They deposit in rings and on valves and clog filters. With the new detergent type lubricating oil for low speed diesels, however, a film coats the carbon and dirt, prevents particles from sticking and holds them in suspension until they are trapped by a filter or drained from the engine.

SEALING TAPES

THE PAINT DIVISION of Pittsburgh Plate Glass Co., Pittsburgh, Pa., has developed several sealing tapes to help speed the production of airplanes. Fabseal, Chromseal and Stratoseal are made in rolls 50 ft. long and in widths varying from 0.5 in. to 24 in. The application of sealing tapes is a great deal faster than the application of caulking compounds with a putty gun or by hand. Fabseal is designed for use as a gasket in the construction of flying boat hulls, gas and oil tanks where internal or external pressures are encountered under constant vibration or sudden impact. It is an impregnated fabric with an interleaf separating the fabric layers. Before the fabric is impregnated with compound, it is treated to make it water-, gasoline- and oil-resistant to prevent wicking action. The tape may be applied to any metal or wood section of a fuel tank, pontoon, etc. Fabseal is 0.01 in. thick when compressed between surfaces under rivet or bolt pressure, and can be doubled up in application when additional thickness is desired.

Cromseal is a solid ribbon of compound with no fabric as part of its composition, and therefore is more flexible than Fabseal. It is especially suited as a gasket material between riveted or bolted surfaces of integral fuel tanks, droppable reserve tanks, as well as a seal for plastic enclosures and glass cockpit framing. It can be molded by



A GENERAL PURPOSE COLD-APPLIED THERMOPLASTIC COATING FOR A WIDE RANGE OF APPLICATIONS

Amercoat No. 33 Thermoplastic Coating is the result of two years of careful development and exhaustive test both in the laboratory and in the field. It meets the urgent demand for an inert, easy-to-apply protective coating for wood, metal and concrete.

Amercoat No. 33 is used as a coating for structural steel, floors, filters, tanks, concrete walls and floors, machinery, ship bottoms and boottopping, concrete urinals, shower bases, laundry tubs... wherever buildings and equipment are exposed to corrosive fumes or the corrosive action of salt water, fresh water or various mild acids or caustics.

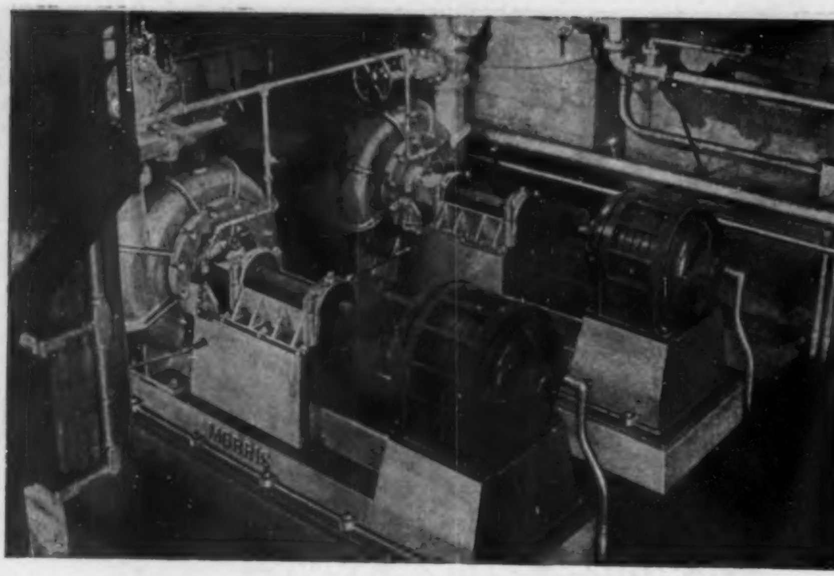
Amercoat No. 33 Thermoplastic Coating is composed of the correct combination of the most inert synthetic resins obtainable. It comes in liquid form and is easily applied with ordinary industrial paint spray equipment or by brush. It may be applied in any number of coats required for any particular condition. It is odorless, tasteless, resistant to moderate abrasion and is dielectric to a high degree.

Amercoat No. 33 does not replace, nor is it a substitute for other Amercoat Compounds which have been developed for more highly specialized requirements.

Amercoat DIVISION

Write for Bulletin No. 33 which gives complete data on AMERCOAT No. 33 and the many uses for which it is suited.

AMERICAN PIPE & CONSTRUCTION COMPANY
P.O. BOX 3428, TERMINAL ANNEX • LOS ANGELES, CALIF.
Canadian Dist: Gunite & Waterproofing, Ltd., 1538 Sherbrooke St., W., Montreal

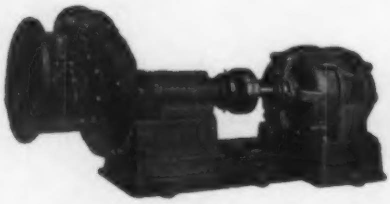


Are your pumps free from

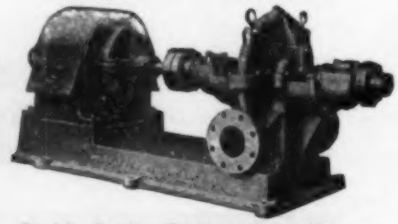
cavitation confrication caducity?

Cavitation . . . eddy currents that reduce hydraulic efficiency: confrication . . . friction that reduces mechanical efficiency: caducity . . . troubles that accompany old age . . . these weaknesses cause unsatisfactory operation of centrifugal pumps.

You can secure freedom from them by using Morris Pumps, because Morris designs are notable for their high overall efficiency, long life and dependable service. The Morris features that secure and maintain thoroughly satisfactory centrifugal pump operation are described in bulletins which will be sent on request.



ST-P Non-clogging Pump — Guaranteed Non-binding for Pulpy Mixtures



Double Suction Horizontally Split Pump for Clear Liquids

MORRIS MACHINE WORKS
Baldwinsville, N. Y.

MORRIS
ESTABLISHED 1864

Export Office:
50 Church St.,
New York 7, N. Y.

CENTRIFUGAL PUMPS

hand to conform to almost any angle, curve or contour. It is also highly resistant to gasoline, oil or water.

Stratoseal is designed for the sealing of the cabins of stratosphere-flying planes. It is a solid ribbon of compound and can be applied between fraying surfaces, overlapping metal joints or over the inside surface of the joints by the use of Stratoseal adhesive.

GLAZING AND SEALING PUTTY

AT THE present time Plastikon putty, made by B. F. Goodrich Co., Akron, Ohio, is employed chiefly for sealing metal joints in combat equipment. It is used for glazing and sealing purposes. The new putty in which man-made rubber entirely replaces natural crude rubber formerly used, is superior to the previous product, according to the manufacturer.

BASIC GLASS FIBERS

IN THE belief that they may assist manufacturers in the development of new postwar materials, Owens-Corning Fiberglas Corp., Toledo, Ohio, announces the availability of seven basic types of glass fibers. The fibers are offered as raw materials for use with other fibers and with plastics and cements and for use in various types of industrial and chemical process equipment. The seven basic glass fibers now available are distinguished by differences in fiber diameter, tensile strength and the glass compositions employed. Four glass compositions are used to provide different properties required for different applications. These properties, each of which is found in a substantial degree in all the fibers and to a maximum degree in some, include resistance to acids and weak alkalis, to high temperatures and to severe exposure to weathering.

Fiberglas fibers are now being used in combination with plastics where they serve as reinforcement for light-weight, high-strength structural parts for aircraft. The Fiberglas plastic parts can be molded at low pressures and temperatures, reducing fabrication costs and manhours. Experience indicates the company says the adaptability of the fibers to similar use as reinforcement for certain cements and plaster-like materials where their high tensile strength may give improved physical properties to the resulting product.

CATTAIL—A SUBSTITUTE FOR KAPOK

LAST YEAR Burgess Battery Co., Chicago, Ill., produced about 75,000 lb. of typha from cattail fluff on an experimental basis as a substitute for kapok. About 50,000 lb. was marketed and the rest used by Burgess for experimental purposes. Production plans this year call for 100,000 lb. monthly—a rate which could easily be stepped up to produce a total of several million pounds in the six-month processing season. Generally speaking the market for typha will be those for kapok, such as life preservers, boat cushions, toys and insulating blankets. More than one manufacturer plans to use typha in the core of softballs this year.

PERSONALITIES

Greystone-Stoller

Paul Mayfield

Charles W. Rippie

Press Association

Bradley Dewey

✦PAUL MAYFIELD, director of sales of the Naval Stores Department of Hercules Powder Co., Wilmington, Del., has been appointed assistant general manager of the department. Mr. Mayfield, who joined Hercules in 1926 as a chemist, has served as naval stores sales director since 1939.

✦JOHN I. YELLOTT has been appointed full-time director of the Institute of Gas Technology at Illinois Institute of Technology, Chicago.

✦HORACE M. WEIR has assumed actively his new position as director of research of Davison Chemical Co., Baltimore, Md. He was graduated from Purdue University in 1917 with the degree of B.S. in chemical engineering. He has been manager of the chemical engineering division of the United Engineers & Constructors, Inc., Philadelphia.

✦WILLIAM R. ARGYLE has been appointed as assistant director of the refining division of the Petroleum Administration for War. Mr. Argyle is on leave of absence as assistant manager of refining of the Sinclair Refining Co., Marcus Hook, Pa.

✦FRANK J. DE REWAL, formerly associated with Batelle Memorial Institute, Columbus, Ohio, has been placed in charge of metallurgical research and development for Delloy Metals and Penn Rivet Corp. of Philadelphia, Pa.

✦A. G. FOURNIER, formerly connected with the Howell Electric Motor Co., is now district representative of the Rowan Controller Co. in California.

✦C. MALCOLM ALLEN has been appointed to the technical staff of Battelle Memorial Institute, Columbus, Ohio, where he will be engaged in research on the engineering properties of metals. Mr. Allen is a graduate of the University of Toledo.

✦CHARLES W. RIPPIE has been appointed supervisor of technical service by the Diamond Alkali Co., Pittsburgh, Pa. Dr. Rippie will make his headquarters in Painesville, Ohio, where the main works operations, together with research and development laboratories of the Diamond Alkali Co. are located.

✦HENRY W. DENNY, vice president of the Commercial Solvents Corp., has been elected a director of the Corps., and Kenneth H. Hoover, manager of the research department has been elected vice president in charge of research and development.

✦VAN L. BOHNSON is retiring from the position of director of the Acetate Rayon Department for E. I. du Pont de Nemours Inc. Dr. Bohnson retires because of health considerations. Fenton H. Swezey, who has been director of research since 1942 will succeed Dr. Bohnson.

✦WILLIAM A. GREEN has joined the technical staff of the Hart Products Corp. and will work with textile manufacturers and processors in connection with their problems in the field of permanent finishes and pigment colors. He was in charge of research and development for the Sayles finishing plants for a number of years, also serving as a superintendent in the Glenlyon Print Works Division.

✦SAMUEL G. BAKER has been appointed director of the electroplating division of E. I. du Pont de Nemours & Co. He had been director of sales of the explosives department. In his new position he will have charge of all electroplating activities. Mr. Baker's service with DuPont dates from 1923. He is a graduate of the chemical engineering department of the University of Washington.

✦ERNEST W. REID has become vice president of research and development for the Corn Products Refining Co.

✦BRADLEY DEWEY has been named director of the Office of the Rubber Director by Donald M. Nelson, Chairman of the WPB. He succeeds William J. Jeffers who resigned recently to resume the presidency of the Union Pacific Railroad Co. Colonel Dewey became deputy director of the Office of the Rubber Director in September, 1942, when he was named by Mr. Jeffers to build the organization of the Office of the Rubber Director by bringing together a group of outstanding engineers, technicians and operating officials who remain with him to complete the rubber program. Colonel Dewey was joint founder of Dewey & Almy Chemical Co. of Cambridge, Mass., with Charles Almy in 1919. For a number of years before coming to Washington his company conducted research in the manufacture of synthetic rubber, and in 1941 was granted priorities to erect with its own funds a plant for making Buna S rubber. This plant went into operation in August, 1942, just before Colonel Dewey departed for Washington.

✦ROBERT M. GATES has been elected president of the American Society of Mechanical Engineers, succeeding Harold V. Coes. An authority on steam generation and industrial management, he is president of the Air Preheater Corp.

✦CHARLES B. MCCOY has been named director of sales of the explosives division, it has been announced by E. I. du Pont de Nemours & Co. He had been serving as director of chemical and miscellaneous sales. In his new position, all sales of the explosives division will be in his charge. Mr. McCoy is a chemical engineer, a graduate of the University of Virginia and the Massachusetts Institute of Technology. He began work for the DuPont Co. in 1928 at the experimental station of the chemical department. Mr. McCoy succeeds Samuel G. Baker, who has been made manager of the company's electroplating division.

SEALS...

propane

steam

water

oils

Simplifies pipe line maintenance

This one Babbitt Sealant will handle 90% of industry's common sealing jobs—as a lubricant-sealer for threaded pipe joints (particularly those subject to vibration, heat or solvent action), as a casing joint seal, a gasket dressing, and in many other applications.

Like all Babbitt Plastic Sealants, Sofset No. 74 assures leak-proof, permanently workable unions that can be taken down easily at any time without damage—an important factor in simplifying pipe line maintenance, saving time, labor, material and money.

Write for Bulletin B-1, describing Babbitt Sealants and their applications

Sealing Specialists for Industry

BABBITT INDUSTRIAL SPECIALTIES CO.

SUITE 3153, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

✦ JULES B. SANDIG, chemical engineer of the Niagara Smelting Div. of Stauffer Chemical Co., has been transferred to the New York Office of the company.

A. L. Gossman

✦ A. L. GOSSMAN has been elected president of Dicalite Co. succeeding C. A. Frankenhoff, who becomes chairman of the board of directors.

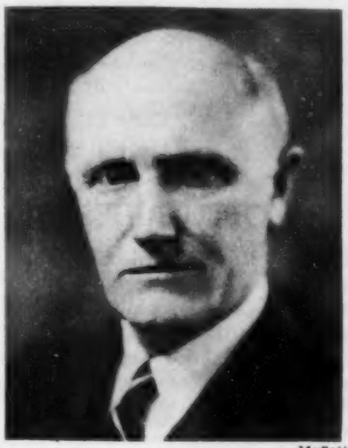
✦ ARTHUR J. GILLIGAN has been appointed chief chemist of the South Braintree, Mass. plant of Armstrong Cork Co. Mr. Gilligan replaces W. L. MacKinnon who has resigned.

Albert Fiedler

✦ ALBERT FIEDLER has been appointed director of research of the Milburn Co., Detroit, Mich. Dr. Fiedler specialized in organic chemistry at Columbia University and the University of Berlin. He has been connected as research chemist with the Celluloid Co., Newark, N. J., plant superintendent and director of research for Eagle Rock Mfg. Co., and a similar position with Empire Laboratories, New York, N. Y. Just previous to his affiliation with the Milburn Co. he was head of the technical and research department of Anabolic Foods, Inc., Glendale, Calif.

✦ LESTER B. KNIGHT, vice president of National Engineering Co., Chicago, Ill., has entered the service of the United States Navy. He has accepted a commission as lieutenant commander and

will be associated with the Bureau of Ships, Washington, D. C. Mr. Knight's services will be used in Washington to assist the Navy in their handling of foundry facilities. His duties with National Engineering have been taken over by R. L. McIlvaine, manager of engineering sales.


Moffett

F. C. Koch

✦ F. C. Koch, former chairman of the Department of Biochemistry at the University of Chicago, and at present head of the biochemical division of the Research Laboratories of Armour & Co., was honored at a testimonial dinner given by the Chicago Section of the American Institute of Chemists on October 1. Addresses were given by Dr. Edward A. Doisy of St. Louis University School of Medicine; Victor Conquest, Director of Research of Armour & Co.; Dr. George K. K. Link of the University of Chicago; and Dr. Koch.


G. Fred Hogg

✦ G. Fred Hogg has been appointed sales director of the naval stores department, Hercules Powder Co., Wilmington, Del. Mr. Hogg, who was formerly manager of the naval stores department office in Chicago, has spent the past year at the chemical company's industrial explosives plant in Hercules, Calif., where he served as technical assistant superintendent and chairman of the plant's War Manpower Committee.

NEW
BAKER HY-LIFT TRUCKS
DESIGNED TO MEET MODERN REQUIREMENTS

NOTE:
Baker has re-designed many of its trucks to meet Industry's needs for increased production:
1. Longer continuous operation
2. Faster handling of material
3. Lower maintenance

● The same advantages which have been designed into these trucks to speed the production of war goods also apply to normal peacetime material handling. The model illustrated, designated as Type H-3, is of 6,000 lb. capacity.

Improvements include a new hydraulic lift system which provides efficient, positive control of hoisting and lowering, increased battery compartment permitting longer continuous operation, operator's guard integral with frame for greater strength and safety, and other features which provide increased efficiency and easier maintenance ... The new improved design is also available in 4,000 lb. capacity. (Type H-2.)

FOR INCREASED PRODUCTION AND EFFICIENCY

Larger battery box (32" x 39½") permits capacity to operate trucks continuously on longer shifts. Chamfered front top corner of battery compartment provides greater visibility for the driver. Sliding type battery cover is equipped with handles for faster servicing.

Controller, contactors, lift motor and pump are grouped together in a convenient control panel. Travel brake is easily adjusted by a single hex nut. Operator's guard built integral with frame for greater strength, provides handy compartment for carrying towing chain, pinch bar, or other tools

Easy steering results from proper design and anti-friction bearings on king pins. All steering levers and rods are inside frame, protected against damage. Frame members are fabricated of heavy plate by hot riveting and arc welding.

Efficient hydraulic lift provides power lifting and gravity lowering, under absolute control at all times. 67" lift for two or three high tiering is standard.

Write for complete information

BAKER INDUSTRIAL TRUCK DIVISION of the Baker-Raulang Company
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In Canada: Railway and Power Engineering Corporation, Ltd.

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Baker INDUSTRIAL TRUCKS


When Industry Reconverts to Peace, Standard Conveyors Will Be Increasingly Important Production Tools

Today we outstrip the world in military aircraft manufacture. Tomorrow fleets of American-built passenger and freight air liners will be cruising the airways being explored and established now.

The American genius for mass production—with precision and speed — will carry on our war-won supremacy in all production.

Right now Standard Conveyors are helping industry to maintain peak production; conveying equipment will have an increasingly important place in mass production of tomorrow.

Plans for the future anticipate the needs of the aircraft and other progressive industries in the peacetime to come.

Write for bulletin A-10

STANDARD CONVEYOR COMPANY
General Offices: NORTH ST. PAUL, MINNESOTA
Sales and Service in All Principal Cities

ENGINEERED FOR FASTER PRODUCTION

✦ A. S. THATCHER has been made director of applied research in the general manufacturing department of Loose-Wiles Biscuit Co., Long Island City, N. Y.

✦ HERBERT EISENHART, president of Bausch & Lomb Optical Co., Rochester, N. Y., was selected as vice chairman of the Committee for Economic Development for New York State. Mr. Eisenhart will direct the work for New York State outside of the metropolitan area and operate under the chairmanship of Mr. James H. McGraw, Jr., president of the McGraw-Hill Publishing Co.

OBITUARIES

✦ SAMUEL RUBEN died September 28 from injuries sustained in an explosion in the chemistry laboratory of the University of California. His age was 30. Dr. Ruben had been engaged in official investigations on government contracts with the Office of Scientific Research and Development.

✦ J. WILLARD HERSHEY, chemistry department head at McPherson College, died September 27 at the age of 67 years after an illness of nine months. He began experimentation with synthesized diamonds, for which he is noted, in 1929, and is the author of several manuals and of scientific papers on this subject and on his experiments with helium.

✦ STUARTS J. SAKS, age 52, president of the Morris Machine Works, Baldwinsville, N. Y., died suddenly on September 5. He had been stricken ill at his summer home the previous day. A world war veteran, and engaged in newspaper work and manufacturing, he had joined the Morris company in 1941 and was made president in 1942.

✦ GEORGE BACHARACH, assistant professor of chemistry at Brooklyn College, died recently at Polyclinic Hospital in Manhattan after a month's illness. His age was 44. He was appointed an instructor in chemistry in September, 1931, and was named assistant professor in January, 1936.

✦ HAL W. HARDINGE died September 15 at his home in New York, N. Y. He would have been 88 years old on September 30. Mr. Hardinge was chairman of the board of the Hardinge Co., New York, N. Y. However, he retired from active participation in the firm's business four years ago when he resigned as president.

✦ THOMAS A. MIGHILL, for many years a research chemist on the staff of Stone & Webster, Inc., Boston, Mass., died suddenly in that city on September 13. He was born in Haverhill, Mass., received the degree of Ph.D. at Goettingen, Germany, and after teaching in Iowa, Ohio, and Massachusetts, joined Stone & Webster in 1896. In 1922 he was transferred to the Blackstone Valley Gas & Electric Co., a property of these interests at Pawtucket, R. I.

FROM THE LOG OF EXPERIENCE

Dan Gutleben, Engineer

DOC CONTINUES to practice hokus-pokus. We were about to lose our custom with the makers of a famous glycerine cough-drop for the reason that they required a sugar of a higher pH which was freely available from our competitors, but not from us. God established the pH of sugar at about 6.8, and Doc explained that if the pH of the competitors' sugar departed from this, it was due to the addition of an adulterant such as sodium carbonate, and inasmuch as we label our containers, "pure granulated sugar", we cannot change the pH. On the other hand, since ash is an essential ingredient of the cough-drop, Doc suggested that the manufacturer should add it at his own plant. A high ash content in the sugar solution reduces inversion at high temperatures, and this is desirable because in this product, predominance of sucrose is the disideratum and high temperature is used in the process. Doc impressed them as being a man of understanding, and so they took him into their confidence. He noted that gum acacia, which is largely used by confectioners, has a pH of around 3.5, and the purpose of the surplus ash in the sugar, whether the confectioner knew it or not, is to neutralize the acidity of the gum acacia. Doc was incidentally admitted into the sanctum sanctorium, but what he learned further is a trade secret and cannot be recorded. He laid out a new procedure, but changed none of the ingredients. By adding a slurry of caustic soda to the gum acacia, he raised the pH and found ameliorating effects not anticipated. The soda assisted in precipitating the dust particles in the fluid gum, thereby expediting the screening. Then, by maintaining a lower acidity in the final compound, there was reduced inversion, and strange to say, the drops dried in half the time, invert syrup offering greater resistance to evaporation of moisture. This doubled the plant capacity, eliminated stickiness and otherwise made improvements in the product, part of which may be due to the shorter processing period. By way of epilog, there is to be added that the customer now insists on the Quaker trademark on his sugar.

TRAMPING is an intrinsic quality of sugar tramps. There is always the urge to explore the other fellow's accomplishments. Taking root begins at 40. The Shackamaxon Log records many tales of the migrations of the local attaches. Typically:

WHEN CARLSTEN PEDERSEN reached the age of 16 in Norwegian Oslo, the principal activity among the young fellows was to leave Oslo. And so Pete sailed towards Greenland for a whaling cruise. The dry summer climate off Greenland, especially in concurrence with the circumstances of a wooden sailing ship, is most inviting to the propagation of lice. In a fo'c'sle crowded with 30 fishermen, they grow like nobody's business. Pete says they cover the floor like sawdust in a saloon and they wear a cross on their backs which the boys call the ace of spades. They are the hardiest animals on earth in their own bailiwick but they cannot live in the humid tropics. Pete avers that he could not rid himself of the pests until he crossed the equator a year after he left Greenland waters.

Every living thing from louse to sailor must be the superior of its species in order to survive. The food which was provided on those old whalers did not excite pleasure, but rather resistance which had to be overcome by the will to live. After a whale was harpooned, the boys went out in rowboats, six to a boat, to "bring home the bacon." The whales are about 30 ft. long and powerful as a tugboat. The sailors have no advance information as to where the whale may rise and sometimes he comes up right under the boat and spills the boys into the sea. When the whale has been killed, the boys chop off his head and hoist the carcass into the ship. Then they cut him into slabs and pack the slabs like sauerkraut into steel vats. There they ferment and convert into oil accompanied by the evolution of a horrible stench which has to be endured to the end of the cruise. Such experiences are interesting to recount to the folks at home, but not pleasant to live through.

WHEN DANIELS, now one of Great Western's outstanding sugar house operators, was a chemist he learned some of the devices by which a foreman outwits the laboratory record to save his own hide. Through lack of vigilance the foreman was discharging a filter press without proper lixiviation. The cake contained excessive sugar, the record of which would call down the opprobrium of the boss. When the sample boy was about to perform his task, the foreman engaged him in conversation and plied him with an uproarious joke. By the time laughter had subsided, the press was cleaned out and the kid gathered up a less incriminating sample. It mattered naught to the foreman to make a liar out of the chemist. The general average of the chemist's behavior was blameless and free of suspicion.

HAROLD SIELAND (son of Supt. Charlie of Caro, Michigan) who is a seafaring man, had his ship blown out from under him. He and a fellow sailor got on a boat that was floating upside down. They heard some noise below and so they righted the boat and found another sailor using the boat as a diving bell. The three drifted ashore, got a few days AWOL and then reported for duty for another cruise.

WHEN A SHIP MOORS at our Pier 46, the refinery gates are carefully guarded by squads of tough Coast Guardsmen. As long as the ship is there, no man can cross the line without a finger-printed Coast Guard Identification Card. A hard-boiled Guardsman compared Sandy's card with Sandy himself in the flesh. He told Sandy he didn't believe it. God could not possibly have disfavored any guy with so much ugliness of appearance as the picture exhibited!

A SALESMAN APPEARED with a proposition to clean surfaces of beaters, evaporators and heat exchangers. He said his experts would come into our plan with tanks, pumps and the solutions necessary to dissolve the scale and take over the job without interfering with our crew. His process was a trade secret. From time immemorial the dissolution of scale has been effected by boiling with acids and caustic soda and he admitted that he also employed boiling. The chronicler's reply was that the long-known fact that calcium sulphate dissolves more readily in cold acid solutions than in hot had only recently been discovered by our operators and so we now apply this new knowledge with advantage, especially as cold acid is less destructive of the metals. We made the bantering remark that we had him licked and were about to hand him a copy of the log describing our successful procedures. During the few seconds required to search for the pages to give to him, he turned on his heels and disappeared through the door flinging back the caustic remark, "You ought to go into the business!"

AT SPRECKELS, P. W. ALSTON is affectionately known as "Gramps"—he is the father of six children, born variously in Hawaii, New Orleans, and Calif. When orders come for Gramps to inpect some distant interests of the House, Mrs. Alston gathers up the family and follows. At Spreckels, he joins in the activities of the factory attaches, but one night he failed to appear as per appointment for the weekly bowling contest. The young fellows of the factory staff waited with impatience. His car was at the curb, but Gramps was nowhere to be seen. In order to prevent him from "pulling off a fast one", the boys jacked up the axle opposite one of the rear wheels of Gramps' car. When he later tried to make his getaway, he found that his starter worked and there was a generous puffing of the exhaust but no locomotion. After several inspection trips around the car and some more pressing of the starter button,

MERCER

EQUIPMENT for the HANDLING of

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UNIQUE

EQUIPMENT for the PROCESSING of

BULKY · CASED · HEAVY

CHEMICAL · FOOD · PLASTIC

MATERIALS

Cranes, Elevators, Lift & Trailer Trucks, Conveyors, Live Skids, Drum Hoists, Winches, Tool Wagons, Carts

Crushers, Pulverizers, Grinders, Reducers, Cutters, Blenders, Mixers, Sifters, Attr. & Hammer Mills

LITERATURE ON REQUEST

MERCER-ROBINSON COMPANY INC.

30 CHURCH ST. • NEW YORK 7, N. Y.

Gramps' keen perception discovered the work of the "5th column." Presently the block was removed and he was off amid the cheers of the boys.

N. A. (LOCK) LOCKWOOD went to Grand Island, Nebr. in 1893 for an interview with Henry Oxnard to determine what the new beet sugar industry had to offer in the way of a career. He had been apprenticed at 12 to his father's foundry and machine shop in the village of Nevada, Iowa. His father died when "Lock" was 16 and shortly thereafter the business was liquidated to provide sustenance for mother and seven children. Lock hit the road as an itinerant machinist and millwright in order to gain an education as a professional engineer. He had inherited the inventive instinct from progenitor Robert Lockwood who crossed the Atlantic in 1632 with a blunderbus of his own invention for operation against wild Indians as a volunteer in the Colonial Army.

After the interview, Henry Oxnard sent Lock to Norfolk (Nebraska) as master mechanic of the new works. He possessed the versatility that such a job demanded at a time when the hacksaw, hand chisel and ratchet drill were the principal tools in the kit. The art of making sound flywheel castings as well as dependable speed governors was still a long way from perfection. When the main engine wheel exploded at Norfolk, Lock assembled the pieces and shrunk a steel tire around the rim. He had no scientific formulas for the design of the tire, but he had experienced judgment, and his faithfulness kept him on the job continuously for 40 hours until the plant was back in service.

The 12-hour shift at the sugar house did not keep him fully occupied. When he was a boy his avocation was baseball. He held the key position of captain and pitcher of his team when the 15-year-old kids went to Ames, Iowa, for a championship match. His team had nine players and no extras. During the nine-mile buggy ride, the first baseman was stricken with a belly ache which put him hors de combat. Lock's cousin was captain of the opposing team of kids, and it fell upon him to pick a substitute from his own sand lot for Lock's first baseman. He pointed to a scrawny kid whom he considered a dud. Lock regarded the lad and thought he would now be "skunked", but he announced that he would lick the tar out of his cousin's team, even if he had to take a kid out of the cradle. This was the kid's first formal game. However, he proved to be a phenomenon and could run like a rabbit. When he was on first, a single would put him home for a score. This kid was Billy Sunday who later became the famous evangelist. Among the keepsakes of Lock's grandson there is a postal card written by Billy at Mayo's Clinic during one of his frequent confinements there. He requested prayers. Praying was not among Lock's specialties, and so he turned the letter over to his eldest daughter.

At 18 he became a near professional as captain of the Waco team of the Texas League. Some wild Texas tin-

horns once collared him and demanded that he "toss the championship game" under penalty of bodily violence. He installed a flask of whiskey in his hip pocket and whenever he needed to stimulate his courage took a slug from the bottle. He won by a score of 6 to 1, and his team mates convoyed him off the field. At Norfolk there was no opportunity to maintain baseball practice and so to substitute for the excitement he acquired a Texas broncho that shied at trains. Lock's favorite diversion was to station himself with his horse and buckboard on the road that paralleled the Northwestern track. When the train came along there was no way of restraining the broncho, and Lock enjoyed the thrill of the race!

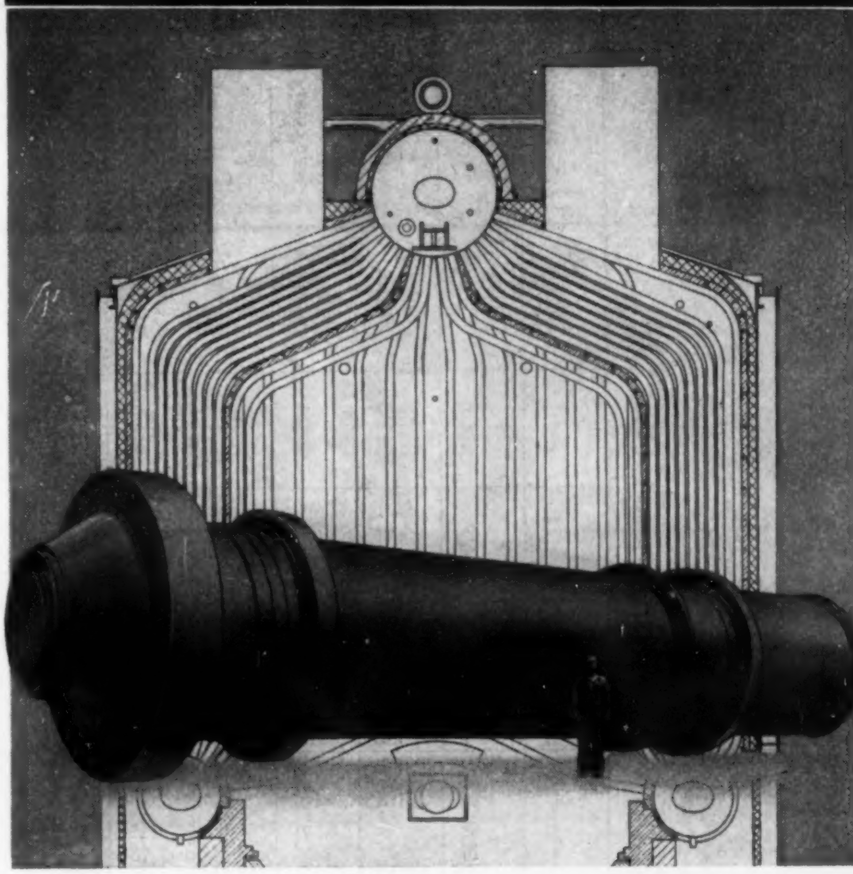
Lockwood's principal obsession was his enmity toward cane sugar competition. So strong was his feeling that he attributed inferiority to the product from cane. He pointed out that Spain and other countries using tropical cane sugar deteriorated, while the northern countries, which subsisted on beet sugar, grew in strength and vigor! He attributed beet sugar's superiority to the frost country and the short ripening period. The formula $C_{12}H_{22}O_{11}$ made no impression on his reasoning. He was not a chemist.

Lock conserved his nervous energy by applying calmness of temper. When Fred Taylor, Supt. of Lewiston, Idaho, complained that the bull gang had unloaded a car of structural steel and stupidly placed at the bottom of the pile the items wanted first, he consoled Fred by one of his proverbial pronouncements, "Well, F. G., there's one thing in the bible I always did believe and that is 'Where there aint nothin' begorra you can't get nothin'."

THE CONTROL OF A PROCESS "by-hand" is a hit-and-miss procedure. Adding "sugar to taste" produces fluctuations in quality. Incidentally, it may exaggerate the operator's sense of importance. Doc's famous cranberry jelly machine produces a standard quality of product which has won wide popularity. The men, having attained the complex of indispensability developed under the old batch and trial-and-error process, arbitrarily dropped their work and demanded doubling of their wages. Competition could not endure so sudden a cost rise, and so the owner released the entire crew of aristocrats and elevated the shipping men to the operating floor. There was no interruption of plant performance and presently the old crew returned to their occupation and submitted to the raising of wages by progressive increment.

UNANTICIPATED ADVANTAGES frequently develop with departures from old paths. Master Sugar Boiler John Rausch (by avocation a great grandfather) finds a new convenience in the presence of his woman assistant. When she observed him fumbling the job of wiping his glasses with a wet handkerchief, she pulled her shirt tail out from under her belt and offered assistance.

UNION



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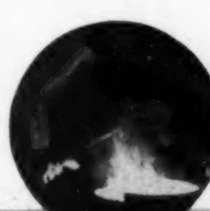

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*Butyl "Cellosolve" Oleate (S-817)	Mildly Fatty	0.892	8	<-45	355-360	<2	I	0.03	N/C, E/C.
*"Cellosolve" Ricinoleate (S-816)	Mildly Fatty	0.929	7	<-70	340-345	<1	I	0.14	N/C, E/C, P.V.B.
Cyclohexyl Stearate (S-247)	Weakly Cyclohexanol	0.890	3-4	20-22	330-335	<2	I	1.10	N/C, E/C.
Diethylene Glycol Monoricinoleate (S-138)	Mildly Fatty	0.972	5-9	<-60	325-330	<8	I	3.40	N/C, E/C, P.V.B.
Glyceryl Monoricinoleate (S-125)	Mildly Fatty	0.965	6-8	<-50	High	<7	I	1.20	N/C, E/C, P.V.B. Synthetic Rubbers
*Methyl "Cellosolve" Oleate (S-810)	Mildly Fatty	0.899	9-10	<-40	355-360	<1	I	0.34	N/C, E/C.
*Methyl "Cellosolve" Phthalate (S-806)	Bland	1.175	5	<-45	335-340	<1.5	I	0.56	N/C, E/C, C/A. P.V.B.
*Methyl "Cellosolve" Ricinoleate (S-786)	Mildly Fatty	0.935	7	<-60	325-330	<2	I	0.02	N/C, E/C, P.V.B.
*Methyl "Cellosolve" Stearate (S-787)	Mildly Fatty	0.890	2	21	320-325	<1.5	I	0.24	N/C, E/C.
Tetrahydrofurfuryl Oleate (S-804)	Mildly Fatty	0.923	6-9	2-5	330-335	<1	I	0.05	N/C, E/C, V.A.C.
Tetrahydrofurfuryl Phthalate (S-774)	Bland	1.194	12	<-15	——	<4	I	1.20	C/A, N/C, E/C.

CODES

I—Insoluble
N/C—Nitrocellulose
E/C—Ethyl Cellulose
C/A—Cellulose Acetate
P.V.B.—Polyvinyl Butyral
V.A.C.—Vinyl Acetate Chloride Copolymer

†Determined by the Shriner-Fuson Percolator Cup Boiling Point Tube.

*"Cellosolve" is the registered trade name of the Carbide and Carbon Chemicals Corporation.
"Cellosolve"—Ethylene Glycol Monoethyl ether.
Butyl "Cellosolve"—Ethylene Glycol Monobutyl ether.
Methyl "Cellosolve"—Ethylene Glycol Monomethyl ether.

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Advertisement

MEETINGS AND CONVENTIONS

MANY IMPORTANT TECHNICAL MEETINGS SCHEDULED FOR NOVEMBER

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS PLANS PROGRAM

THIRTY-SIXTH annual meeting of the American Institute of Chemical Engineers will be held in Pittsburgh, Pa., Nov. 15-16, it has recently been announced. Headquarters will be at the William Penn Hotel.

Tentative program plans now include the following papers as possibilities for the meeting: "Enthalpy Effects in the Fractionation of Binary Mixtures," by J. Griswold; "Behavior of Nickel and High-Nickel Alloys in Hydrochloric Acid and Hydrogen Chloride," by W. Z. Friend and B. B. Knapp; "Condensation of Vapors of Immiscible Liquids," by R. Hazelton and E. M. Baker; "Extraction of Acetic Acid in Methyl Isobutyl Ketone with Water in a Wetted-Wall Tower," by D. S. Brinsmade and H. Bliss; "Flooding Velocities in Packed Columns," by O. A. Hougen and W. A. Bain, Jr.

Also being considered are the following: "Calculation of Plate Columns for Distillation of Binary Mixtures," by R. R. White; "Pressure Drop and Flooding Velocities in Packed Towers," by E. M. Schoenborn and W. J. Dougherty; "Development and Application of a General Solution to Adsorption Kinetics," by R. C. Briant and J. Coull; "Area Source Liquid Distribution Through Unconfined Tower Packing," by R. S. Tour and F. Lerman; "Closures for High-Pressure Vessels," by D. P. Meigs; "Chemical Engineering Applications for Plastics," by T. S. Carswell and R. U. Haslanger; "Annular Heat Transfer Coefficients for Turbulent Flow," by E. L. McMillen and R. E. Larson; "Postwar Planning Problems," by P. W. Meyeringh.

PACKAGING CONVENTION SCHEDULED FOR NOVEMBER

PACKAGING Institute, Inc., will hold its annual conference November 4-5 at the Hotel New Yorker, New York, it was announced recently by Joel Y. Lund, president of the Institute and vice president, Lambert Pharmacal Co., St. Louis, Mo. Technical wartime packing problems, with particular reference to technical developments in packaging emerging from changes in the war economy will be the principal topics for discussion.

INDUSTRIAL HYGIENE FOUNDATION TO MEET AT MELLON INSTITUTE

EIGHTH annual meeting of the Industrial Hygiene Foundation will be held at Mellon Institute, Pittsburgh, Pa., Nov. 10-11. The Foundation's Board of Trustees, meeting in New York on Aug. 25, voted unanimously for the annual meeting as a help in maintaining healthful conditions in war plants. Practical, workable measures for the health maintenance of men and plants will comprise the program for the annual meeting. Foundation members and subscribers are invited to send their program suggestions and industrial health questions they wish answered.

SOCIETY OF THE PLASTICS INDUSTRY MEETS IN NEW YORK

THE SOCIETY of the Plastics Industry will hold its fall meeting in New York, Nov. 8-9, at the Waldorf-Astoria Hotel. The meeting will be devoted almost entirely to war production problems which demand collective consideration, new materials and processing methods that have been developed, material supply and allocation routine, manpower, civilian production, and planning the future of the industry. Persons planning to attend the fall meeting are advised to make rail, plane and hotel reservations early. Subsequent notices will report on the speakers and the papers which will be delivered.

SAKLATWALLA DELIVERS RICHARDS' MEMORIAL LECTURE

ALLOY STEELS were discussed by Dr. B. D. Saklatwalla of Pittsburgh, in his Richards' Memorial Lecture before the Electrochemical Society in New York Oct. 14. Dr. Saklatwalla stressed in particular the essential constituent, vanadium, in modern steels which have made high strength combined with low weight possible.

Dr. Saklatwalla was born in Bombay, India and graduated from the University of Bombay, after which he continued his technical education in Germany. In 1906 the British Iron & Steel Institute of London awarded him the Andrew Carnegie Scholarship to carry out research on phosphorus in steel. Dr. Saklatwalla commenced his industrial career in the United States in 1909, joining the newly-organized American Vanadium Co. of Pittsburgh. Here he devoted his efforts to the pioneer work of devising new smelting processes and finding appropriate applications for vanadium in steel metallurgy. He continued his activities in the field of vanadium, and also in connection with the production of ferro-chrome, ferro-silicon, ferro-tungsten and ferro-titanium. He was senior vice president of the Vanadium Corporation of America from 1919 to 1935, during which period he also designed special electric furnaces and control devices. Since 1935, Dr. Saklatwalla has been engaged in the development of metallurgical projects in the capacity of independent consultant.

AMERICAN GAS ASSOCIATION CHANGES DATE OF CONVENTION

CONFLICT of dates in St. Louis with baseball games has resulted in such hotel and travel facilities congestion as to make necessary a change in the dates for the annual meeting of the American Gas Association. The executive board decided that the 25th annual meeting shall be held at the Jefferson Hotel in St. Louis, October 26-28.

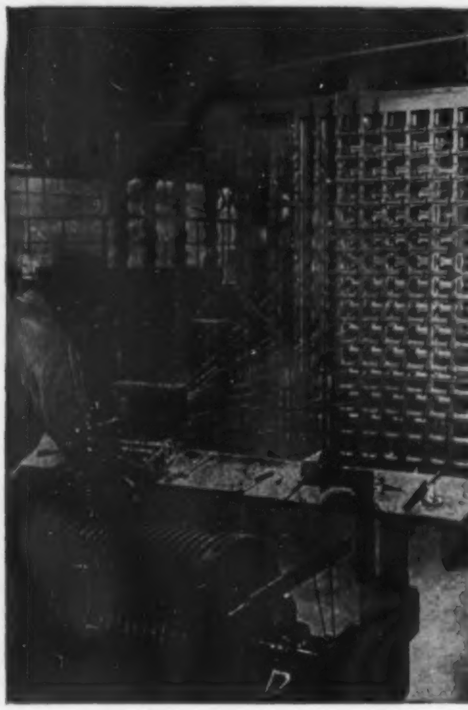
All members are advised to cancel present rail reservations and make new ones promptly. Hotel reservations previously confirmed will be honored for the new dates. As far as possible the meetings will be arranged in the same order and the same relative times as previously for the original dates.

CORNELIUS FRANCIS KELLEY AWARDED RAND MEDAL

AT A MEETING of the board of directors of the American Institute of Mining and Metallurgical Engineers in New York City, Cornelius Francis Kelley, chairman of the board of directors of Ana-

CALENDAR

OCT.	18-22	American Society for Metals, annual convention, Palmer House, Chicago, Ill.
NOV.	8-11	American Petroleum Institute, 24th annual meeting, Palmer House, Chicago, Ill.
NOV.	14-16	American Institute of Chemical Engineers, 36th annual meeting, William Penn Hotel, Pittsburgh, Pa.
DEC.	6-11	Nineteenth Exposition of Chemical Industries, Madison Square Garden, New York, N. Y.
FEB.	20-24	American Institute of Mining and Metallurgical Engineers, annual meeting, Waldorf-Astoria, New York.



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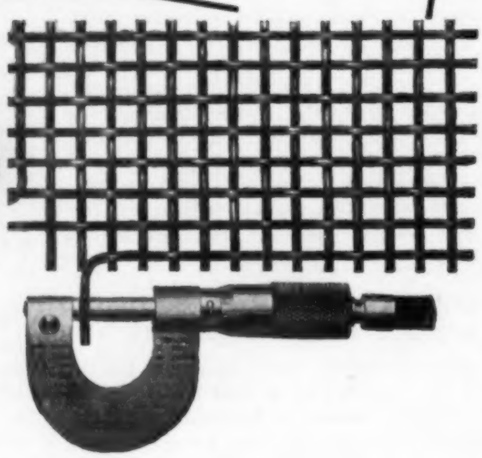

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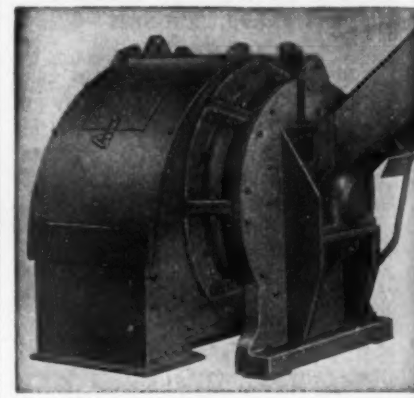

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conda Copper Mining Co. was awarded the Charles F. Rand Memorial Medal for "distinguished achievement in mining administration." Mr. Kelley is the second recipient of the Institute's Rand Medal, the first having been awarded to Mr. Robert Crooks Stanley, chairman of the board of the International Nickel Co. in 1941.

Other than being chairman of the board of Anaconda Copper Mining Co. and dominant figure in a large group of associated companies, Mr. Kelley was a director of the New York World's Fair, 1939, Inc. and is a member of the American Bar Association of Montana, State Bar Association, American Mining Congress, American Institute of Mining and Metallurgical Engineers.

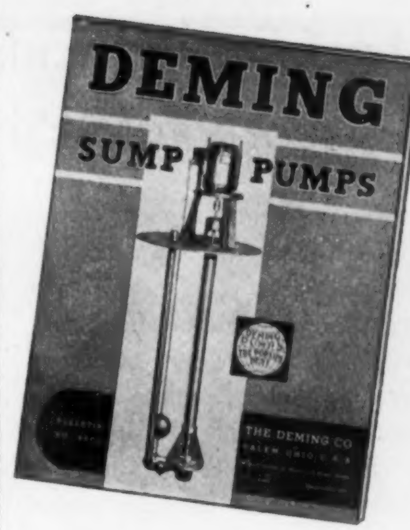
LIGHTING EQUIPMENT EXHIBITION PLANNED

A POSTWAR annual lighting equipment exhibition and congress will be sponsored by the Industrial & Commercial Lighting Equipment section of the National Electrical Manufacturers Association, according to a recent announcement. The section believes that there is a definite need for such an exhibition in order to provide opportunity for manufacturers and contractors to meet and discuss constructive developments and plans in this important postwar field. The section has named nine members of an exhibition committee which will make preliminary plans toward the holding of the exhibition as soon as practicable after the war.

TWO NEW MEDALS ANNOUNCED BY METALS SOCIETY

ONE OF THE highlights of the 25th annual National Metal Congress in Chicago the week of October 18 will be the presentation of two newly-created medals, the Gold Medal of the American Society for Metals and the A.S.M. Medal for the Advancement of Research. The Gold Medal will be awarded to one recognized for outstanding metallurgical knowledge who has shown great versatility in the application of science to the metal industry. He will have exhibited exceptional ability in the diagnosis and solution of diversified metallurgical problems relating to different fields of metallurgy of one metal or individual fields applied to several metals.

Recipient of the Research Medal will be an executive in an industrial organization, the principal activity of which is production or fabrication of metals. He will be one who, over a period of years, has consistently sponsored metallurgical research or development and by his foresight and his influence in making available financial support has helped substantially to advance the arts and sciences relating to metals.



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Among the long list of owners of one or more Deming Sump Pumps are many of the largest companies in their respective industries. A partial list of these companies is included in Bulletin No. 4603. Write:

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DEMING PUMPS for War Industries

SELECTIONS FROM CONVENTION PAPERS

CHEMICAL MANPOWER FOR POSTWAR INDUSTRIES

ON THE BASIS that "today's scarcities are tomorrow's surpluses", it is probably safe to predict that chemical manpower will be available in abundance once demobilization is completed. The war industries, particularly those making explosives and chemical munitions, will quickly release thousands who have capitalized on the recent seller's market to obtain jobs as chemists and chemical engineers. These men will seek and perhaps demand chemical work at war-inflated salaries, despite the fact that many will have had inadequate training and only very specialized experience. Some, however, will have proved their worth and feel they have a real claim on chemical jobs.

In addition to the war workers, we must anticipate the return of an even larger group from the armed forces. There will be many reserve officers who went into the services directly from the universities. Others fortunate enough to have had a few years of industrial experience will offer less of a problem, because most of them will have their old jobs waiting for them. Those who will be most difficult for industry to absorb will be the boys who were drafted before they finished their college courses or who were over-accelerated and, therefore, undertrained. The logical places for both the non-graduates and the "90-day wonders" is back on the campus. But can they be so persuaded?

It is to the best interest of all of us to see that these manpower "surpluses" do not dilute and depress the general level of professional competence. Obviously, something more than compensation is involved. That will be the approach of the unions and there will probably be greatly renewed activity in these circles immediately after the war.

Our responsibility is to create and encourage greater professional consciousness among chemists and chemical engineers. That will not come from merely "professing" to some creed or canons of ethics. Only by unselfish service and continued interest in raising and maintaining the highest standards of our profession can we hope to obtain the public acceptance and recognition we deserve. We can and should start now

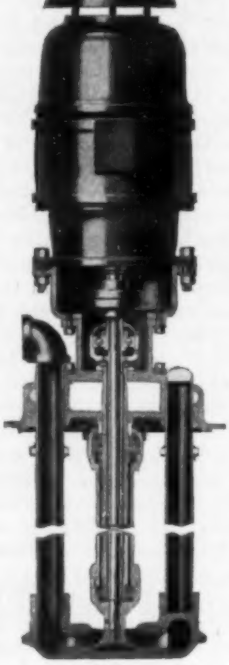
Metal-Eating Acids Go Hungry with Amsco-Nagle Pumps on the Line

No clairvoyant powers are claimed for Amsco engineers, but even had they foreseen everything which has happened during the past four years, they could not have designed pumps better adapted to current conditions in the chemical process industries.

In many such pump applications, the cost of upkeep is more important than the original cost of the pump. This is especially true now, when replacement parts are not only a drain on the nation's stockpile of metals, but are not always readily procurable; and the manpower to install replacement parts is often lacking. Yet, the destructive forces of corrosion and abrasion on pump parts continue to operate without regard to wartime emergency.

• Amsco-Nagle centrifugal pumps were designed for the trouble-free handling of corrosive and abrasive materials in solution as well as the pumping of clear liquids. They have numerous features which substantially decrease maintenance attention and replacements.

The water ends are made of the metal, ferrous or nonferrous, most resistant to the destructive forces encountered on the specific installation. A broad metallurgical background, and thirty years of pump building, are back of these selections. Also from the standpoint of design, they adequately cope with problems involved in pumping acids.



Type "SW", one of the three vertical types, featuring inverted inlet to eliminate gas binding.

Various types of impellers are available to assure the greatest hydraulic efficiency. One type of impeller is employed for handling clear liquid, another type for light slurry or viscous liquid and a third type for thick slurry or debris-laden liquid. Still other impellers are available to suit special operating conditions.

Ask for Bulletin No. 940 on Amsco-Nagle pumps.

P-78-N shows a partial shipment of 2" Type "T" Amsco-Nagle horizontal pumps for an ordnance plant. The water ends are made of an alloy resistant to the acids used in making T.N.T.

Amsco

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in solving many of the chemical manpower problems of the postwar period.

Sidney D. Kirkpatrick, Editor, *Chem. & Met. Eng.*, before the American Chemical Society, Pittsburgh, Pa., Sept. 6–10, 1943.

EXTRACTION OF POTASSIUM CARBONATE FROM WYOMINGITE

In conjunction with the study of a process for production of pearl ash and soda ash from wyomingite and trona, the kinetics of the base-exchange reaction between wyomingite and sodium carbonate was investigated both in a 1-gal. and a 100-gal. autoclave. The effect of concentration of reactants, time, and temperature on the rate of extraction of potassium from the wyomingite was determined and an equation relating these variables was derived.

Range of temperature, ratio of Na_2CO_3 to wyomingite and time studied were, respectively, 185-210 deg. C., 0.303-0.550, 0-5 hours. Microscopic examination of the wyomingite before and after reaction showed that the only potassium-bearing mineral attacked was leucite, indicating that the Lembert reaction was the only one occurring.

It was found that at constant temperature the relationship between extraction of K_2O, time, and initial ratio of Na_2CO_3: wyomingite could be expressed by the equation:

$$\log \frac{\dfrac{1}{1-Z}}{C_e} = aC^t$$

where Z is extraction of K_2O, lb. per 100 lb. wyomingite, C_e is equilibrium extraction of K_2O, C is initial ratio of Na_2CO_3: wyomingite, t is reaction time in hrs., and a is a constant.

Stanley J. Green and C. E. McCarthy, Bureau of Mines, Eastern Experiment Station, before the American Chemical Society, Pittsburgh, Pa., Sept. 6–10, 1943.

ABSORPTION OF CARBON DIOXIDE BY SODIUM HYDROXIDE SOLUTIONS

An investigation has been carried out to obtain data on the absorption of carbon dioxide in aqueous solutions of sodium hydroxide which will be of value for design purposes and which will contribute to a better understanding of the mechanism of transfer for the case of absorption accompanied by rapid and irreversible chemical reaction in the liquid phase. The effects on the overall gas absorption coefficient, K_Ga, of sodium hydroxide and sodium carbonate concentrations in the liquor, gas and liquor rates, and liquor temperature have been studied, employing a 6-in. diameter column packed with ½-in. carbon Raschig rings.

The rate coefficient was found to increase rapidly with increasing sodium hydroxide concentration up to a concentration of about 2-normal and to decrease with further increase of sodium hydroxide concentration above this value at different constant liquor rates and sodium carbonate concentrations. K_Ga was found to decrease approximately linearly with increasing sodium carbonate concentration and to increase as approximately the 0.28 power of liquor rate and the sixth power of absolute

quor temperature. The effect of gas ate was found to be negligible under he conditions of the test.

A graphical correlation of K_Ga with iquor concentration is presented which an be used in making design calculations. The reliability of this correlation s proved by showing close agreement etween experimentally determined and omputed values of the volume of packng required to effect a given separation nder conditions such that the liquor oncentration and temperature change onsiderably over the tower height.

Experimental results are interpreted s indicating that the chief resistance to ransfer exists in the liquid phase; in act, the gas phase resistance appears o be practically negligible. This is ontrary to what might be expected rom the theory and experiments of hatta for batch absorption. Values of he over-all coefficient are higher than hose which have been reported for absorption of carbon dioxide in aqueous olutions of either sodium carbonate or iethanolamine.

John B. Tepe, E. I. duPont de Nemours & Co., Wilmington, Del., and Barnett F. Dodge, professor and head of chemical ngineering, Yale University, New Haven, Conn., before the American Institute of Chemical Engineers, New York, N. Y.

OAD REGULATING SYSTEM OR SYNCHRONOUS CONVERTERS

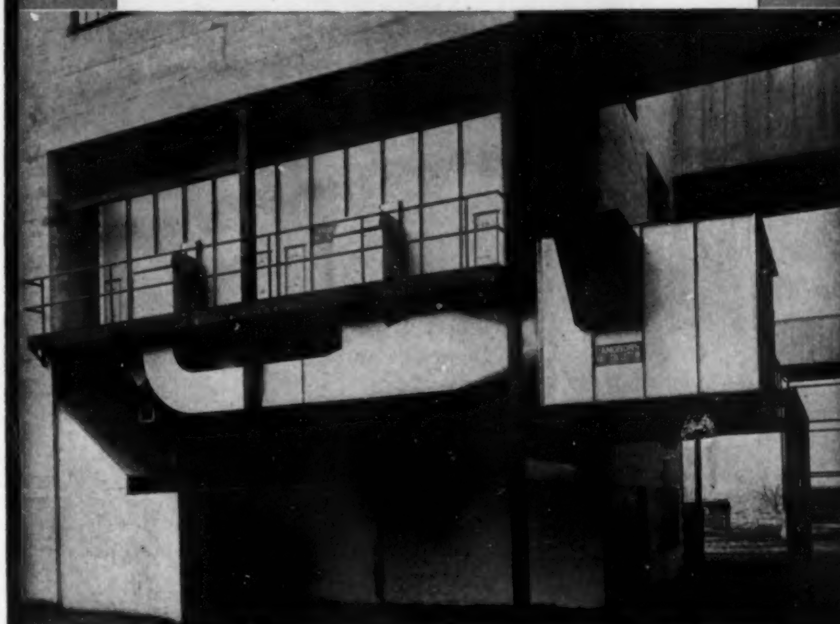
CONSTANT CURRENT required by electrolytic cells cannot be obtained from synchronous converters except by continuus adjustments of converter output to ompensate for variations in incoming ine voltage and cell circuit resistance. n large converter stations independent roups of converters connected to indeendent electrolytic loads cannot be ade to supply a constant current even hen close persistent manual control s exercised because adjustments in one oad will affect incoming line voltage nd thereby disturb the other loads.

The system described was developed o control automatically the output of a arge converter station. It utilizes conact-making ampere meters measuring otal current and functioning in an electrical circuit to operate motor-driven ontrol rheostats on several selected onverters, causing them to pick-up or rop-off within limits, thereby holding otal current output constant. This egulating system has proven satisfactory and contributes to improvement in verall plant performance by reductions n labor and reductions in power cost hrough improved load factor.

Experience gained from the replacement of manual load control by automatic regulation employing the methods described have proven that direct curent supplied to electrolytic cells from group of synchronous converters can e held practically constant. The regulating system is simple, practical, comparatively inexpensive, and trouble-free n operation. By its use several benefits re obtainable which tend to reduce osts and improve overall performance f the process or plant.

These benefits are briefly: (1) the roducts of electrolysis will be manu-

DUST



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REX-WELD's war service is not confined to the planes themselves. In the steel mills and munition factories, on the production and assembly lines, everywhere that war-worthy flexible connections are needed, REX-WELD is rendering vital service.

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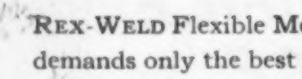
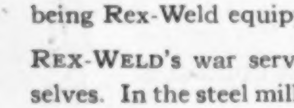


Type RW-81
(annular corrugations)



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factured at steady rates and therefore the control of materials to and from the cells may be simplified; (2) time spent by the converter station attendants observing load meters and regulating machines is greatly reduced and may be gainfully utilized for other work; (3) performance records for the cell room and the converter station may be determined more accurately and with less work; for example, it is no longer necessary to trace the current charts with a planimeter in order to determine accurately the average current or total ampere hours; (4) controversies between cell room and converter station personnel arising out of variations in current are eliminated; (5) the "load factor" of the entire plant can be increased toward unity, thereby contributing to lower purchased power costs and minimum firm power contracts; (6) the voltage of the power transmission system is steadier since, with converter output held constant by automatic regulation, the cumulative effects on transmission line voltage drop caused by load swings in the plant itself are minimized.

L. H. Fletemeyer, Electrochemicals Dept., E. I. duPont de Nemours & Co., Niagara Falls, N. Y., before the 83rd meeting of the Electrochemical Society, Pittsburgh, Pa.

NEW PHOSPHATE COATINGS WITH UNUSUAL CORROSION RESISTANCE

PHOSPHATING of certain metals for increased paint adherence has come into widespread use in the last few years. In general, the purpose of coating the basis metal has always been to increase the adhesion of the supplementary organic coating, such as lacquer. The resultant corrosion resistance was thereby increased. As a rule, corrosion resistance of the basis metal alone never increased appreciably if no additional coating, such as a lacquer, oil, or wax, was applied after phosphating. Employing the predip method now makes it possible to obtain decided corrosion resistance of zinc-plated steel without a supplementary organic coating.

The parkerizing phosphoric acid process at first required a treatment of from 3-4 hours. The addition of manganese dihydrogen phosphate produced an appreciable reduction in time of treatment, and somewhat later the addition of a small amount of a copper salt reduced the time to about 10 minutes. This shortened time permitted the use of the process on a conveyor system. Still later improvements were directed toward further time reduction, as well as spray application, and improvement of the crystal structure of the surface of the basis metal. The addition of alkali nitrates or nitrites was an important step in the development of better phosphating solutions.

Present commercial specifications for phosphate coatings always include a subsequent treatment, because the film obtained has little, if any, protective value of its own. In the lacquering of zinc-plated steel, the presence of corrosion is still evidenced by the white powder formed from the zinc by the subsequent flaking off of the organic finish.

Steel parts used on the inside of instruments require that there be not only no rust formation, but also that there be no other corrosion products formed which might get into bearing surfaces and increase friction.

By the use of a special predip prior to phosphating, it is possible to increase the corrosion-resistant quality of the resultant film. Metal parts with this finish find application even without any supplementary organic coating. However, when an organic coating is applied, such as lacquering, oiling, or waxing, the corrosion resistance is greatly improved over that ordinarily obtainable by phosphating. The activity of the titanium disodium phosphate predip is probably due to the adsorption of a film containing the phosphate ion on the metal surface prior to the treatment in a phosphoric acid bath. The titanium is no doubt present in the predip as a colloid and possibly as a complex phosphate compound.

George Jernstedt, Westinghouse Electric & Mfg. Co., Newark, N. J., before the Electrochemical Society, Pittsburgh, Pa., April 8–10, 1943.

• • •

Recommended Safe Concentrations of Common Toxic Substances Used in Industry

	Parts per Million Parts of Air
Ammonia	100
Amyl acetate	400
Aniline	5
Arsine	1
Benzene (benzol)	100[1]
Butyl acetate	400
Cadmium	0.1*[1]
Carbon bisulphide	20[1]
Carbon monoxide	100
Carbon tetrachloride	100
Chlorine	1
Chlorodiphenyls	1*
Chloronaphthalene	1 to 5*
Chromic acid and chromates	0.1*[1]
Dichlorbenzene	75
Dichlorethyl ether	15
Ether	400
Ethylene dichloride	100
Formaldehyde	20
Gasoline (benzine)	1000
Hydrochloric acid	10
Hydrogen cyanide	20
Hydrogen fluoride	3
Hydrogen sulphide	20[1]
Lead	0.15*
Manganese	6.0[1]
Mercury	0.1*[1]
Methanol	200
Monochlorbenzene	75
Nitrobenzene	5
Nitrogen oxides	50
Ozone	1
Phosgene	1
Phosphine	2
Sulphur dioxide	10
Tetrachlorethane	10
Tetrachlorethylene	200
Toluene (toluol)	150
Trichlorethylene	200
Turpentine	200
Xylene, coal tar naphtha (xylol)	150
Zinc oxide fumes	15*

Other Dusts

Asbestos—10 million particles per cu. ft. of air.

Dusts containing less than 10% free silica—50 million particles per cu. ft. air.

Dusts containing from 10–70% free silica—10 million particles per cu. ft. air.

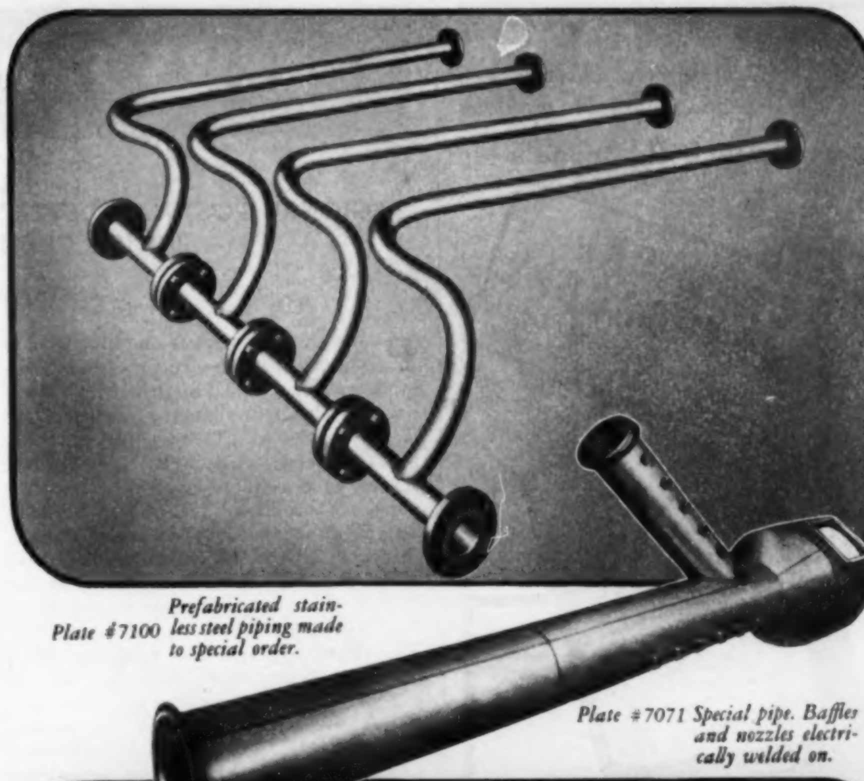
Dusts containing more than 70% free silica—5 million particles per cu. ft. air.

All other dusts—50 million particles per cu. ft. air.

Note; Dust limits include only that dust which is 10 microns (1/2500 in.) or less in size. Equipment and technique recommended by the U. S. Public Health Service for air sampling must be used with these standards. There are other good methods, but for comparison purposes they must be calibrated to this method and these standards. These standards are for exposures not exceeding eight hours daily.

* Milligrams per cu. meter.
[1] American Standard.

Myron A. Snell, supervising engineer, Hartford Accident & Indemnity Co., Hartford, Conn., at the 50th annual meeting of the Society for the Production of Engineering Education, New York, N. Y., June 27-29, 1943.



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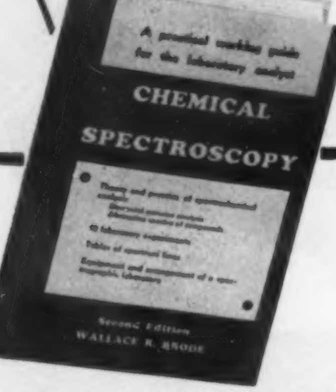

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NEWS FROM ABROAD

REGIONAL POSTWAR DEVELOPMENT PLANS PROPOSED FOR BRITISH CHEMICAL INDUSTRY

Special Correspondence

POSTWAR PLANNING is one of the most popular pastimes in wartime England, and it would be surprising indeed had the chemical industry remained entirely unaffected. There is no need for physical reconstruction in the chemical trades, such as there is in blitzed towns, nor must the British chemical industry be put on an entirely different footing, like agriculture, to ensure its survival after the war. Postwar planning in the British chemical industry starts from the assumption that, on the one hand, exceptional opportunities will exist after the end of hostilities and that, on the other hand, competition by new producers will make a return to prewar methods of production and marketing impossible. Besides, wartime experience has shown the value of many expedients used to meet particular circumstances and the need for closer cooperation all round.

The novel ideas at present discussed in the British chemical trades may be summarized under three headings: Research, production, distribution. As regards research, it is generally realized that far greater expenditure than in the past will be necessary if British manufacturers are to maintain their position in the world markets. Few of them, however, are able to draw up and carry through an ambitious research program without outside help. They must therefore either cooperate in research or rely on government assistance. Both these ways have been pursued. Some of the leading pharmaceutical manufacturers have formed a therapeutical research corporation, and central research institutes have been set up in various branches of the chemical industry. The Government has at the same time extended its research activities. Not only have the official research institutes greatly extended the scope of their work, but official agencies have also played a prominent part in coordinating research activities. The establishment of research stations by certain trade associations and indus-

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ries has helped progress in this direcion, since official bodies find it easier o collaborate with these than with rivately-owned laboratories.

The problem of coordination of researh has not, however, yet been fully olved. While cooperation has greatly mproved in the field of research proper, t has not yet been possible to arrive t satisfactory arrangements for the ontinuation of the investigations on a emi-industrial scale. This stage of researh requires large funds, and there s, of course, the question who is to rofit from industrial opportunities pened by such work. Progress has been ade in the exchange of knowledge and xperience between individual manufacurers, and the authorities in charge of ar production have done much to enure that useful developments in one lant are made known to other producers. Much, however, still remains to e done in this field, and under peaceime conditions some more elaborate ystem of exchange for information and xperience may be necessary. Some critis go even so far as to suggest a complete overhaul of the patent system which has not indeed kept pace with the advance of industrial requirements. Less radical reformers will be satisfied with a comprehensive system for the pooling and exchange of works experience.

In the field of production most observers start from the assumption that the British chemical industry cannot hope to maintain its position and to participate in future progress unless it is prepared to give more thought than hitherto to indigenous raw materials among which coal features prominently. Raw material consciousness has been stimulated by the needs of the coal mining and other basic industries, but in chemical quarters it is also realized that full advantage of Great Britain's greatest raw material asset can only be taken if the commodity coal is worked up into its most valuable form. Some of the leading coal mining districts were before the war among the most depressed industrial areas of the country, and all postwar plans for such regions as Scotland, Tyneside and South Wales are based on a revival of the coal industry by full utilization of all opportunities for chemical treatment of coal. Typical in this respect are the plans for the mining area of South Wales which have lately been published.

ELECTRIC POWER

It is hoped to produce large amounts of electric power from coal at an economical price (about 0.15 d per unit) and to build up a number of electrochemical and electrometallurgical industries, including the production of magnesium, aluminum, ferro alloys, and calcium carbide. As far as aluminum is concerned, it is even proposed (by W. C. Devereux, chairman of High Duty Alloys Ltd.) to abandon the Bayer process in favor of an alternative process for the reduction of shale in an arc furnace with coke to form ferro-silicon-aluminum which is afterwards electrolyzed to give substantially ferro-silicon and aluminum. The shale is to be pretreated to

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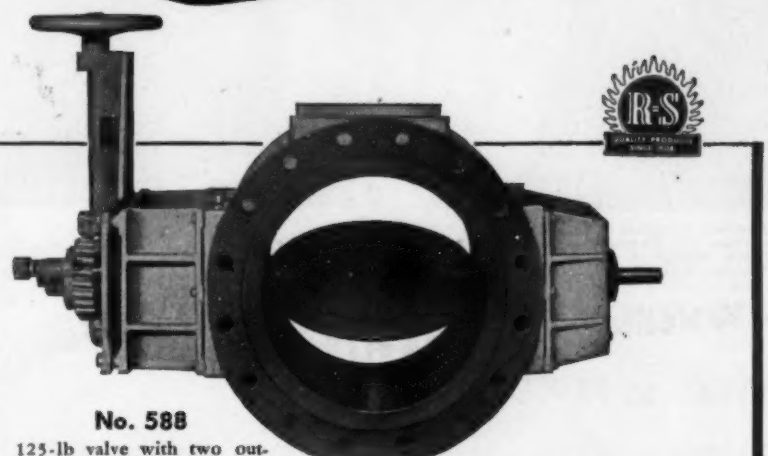

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Neoprene, a product of Du Pont, being dumped from the polymerization kettle. Photo courtesy E. I. du Pont de Nemours & Co., Inc.

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remove volatile constituents which may be collected in the form of oil, while the gases evolved are to be used to heat the shale. Alternatively, alumina of a very high degree of purity—suitable not only for aluminum production but also for the manufacture of electrical apparatus—may be made cheaply from shale by a modified lime-soda process in which silica contamination of the final product is avoided by addition of a reagent to the clay or shale.

As South Wales is close to the sea, most raw material problems could be solved by imports. In the case of magnesium, however, the raw material question is to be answered by use of sea water. If cheap electricity can be supplied on the basis of coal, the production of aluminum and magnesium would open up opportunities for the manufacture of many fabricated light metal parts. The solution of the coal-oil problem is looked for in a combination of low-temperature carbonization with Fischer-Tropsch synthesis; the rich gas from the low-temperature carbonization plant would be decomposed with steam to yield a mixture of hydrogen and carbon monoxide which would be suitable as raw material for oil synthesis. Up to the present the various interests have unfortunately shown little enthusiasm for cooperation. A Fischer-Tropsch plant does not yet exist in the British Isles, but it is claimed that by a combination suitable for British conditions the following products could be obtained from one ton of coal: 7.5 cwt. of smokeless fuel, 4.5 gal. of butane and propane, [illegible] gal. of motor spirit, 25 gal. of dies[illegible] oil, 3 gal. of refined tar acids, 20 [illegible] of paraffin wax, and 130 lb. of pitc[illegible] It is, however, realized, that to obta[illegible] the necessary capital at low rates of interest government assistance would be required.

It is also hoped to base chemical industries on the limestone and dolomite deposits of South Wales and to use the sea as a source of chemical raw materials. The various intermediate products obtained from different chemical plants could be made the starting materials for finished products. Special importance attaches in this connection to cresol and phenol for the plastics industry and to acetylene for the manufacture of synthetic rubber. It must be admitted that the present knowledge on the economic side of these contemplated new industries is inadequate. Even the most ardent protagonists of a progressive policy in South Wales consider the establishment of a large research institute to cost £500,000 and to employ 1,000 people essential for further development. Until the detail problems have been studied, all projects for an expansion of chemical production are necessarily somewhat vague.

The plans for South Wales are typical of projects ventilated for other parts of the country. They aim at the elimination of permanent unemployment by means of full utilization of local raw materials and transport advantages. These plans need not, however, be restricted to the coal mining districts. It is more than likely that

British agriculture will need far more chemical fertilizers after the war than used to be applied before 1939, and while such materials as phosphates and potash salts must of course be imported, there is certainly great scope for an expansion of the local production of nitrogenous materials and lime fertilizers. If chemical manufacturers can look forward with reasonable assurance to continuing large demands for these fertilizer materials, installation of the necessary plant will present no financial problem.

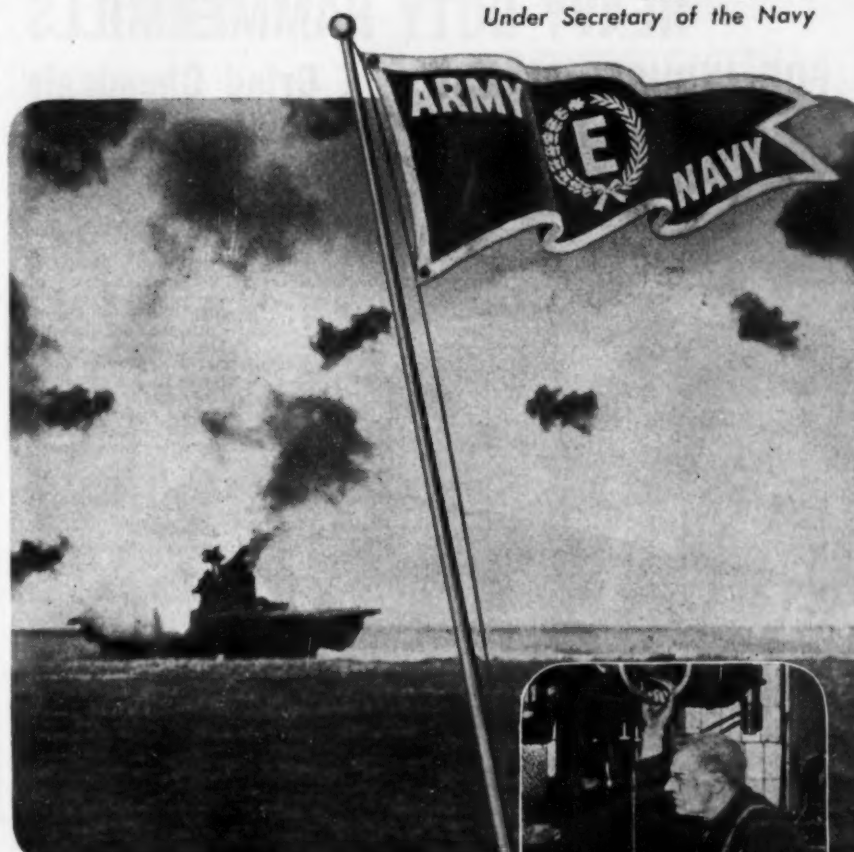
As far as the distribution side is concerned, a greater degree of cooperation must be looked for in future, if only as a result of wartime experience. The above-mentioned regional production and reconstruction plans envisage a distribution of chemical materials between different firms on novel lines, probably by long-term contracts, possibly at prices which are not arrived at by the usual open market methods. As far as imports of chemical raw materials are concerned, it seems quite likely that the present system of imports by government offices and distribution by cooperative agencies under government control will be continued at least as long as the present import restrictions remain in force. In the home market of consumption goods firms with an extensive retail organization, such as one of the leading pharmaceutical manufacturers, have been found to possess such a great advantage over their competitors that the latter will have to make special arrangements to halt the trend towards the big chain-store retailers which threatens to control their market.

EXPORT MARKETS

As far as the export markets are concerned, British chemical manufacturers believe that a considerable part of their former trade has been irretrievably lost through the setting up of new industries in overseas markets. On the other hand, export demand for many of the newer chemical products is likely to be much bigger after the war, and the chemical exporters of Continental Europe are likely to be unable, at least for some time after the war, to serve their overseas customers, so that manufacturers in Allied countries will have to meet a greatly increased demand. British chemical manufacturers hope in particular that they will be able to strengthen their position in the market of coal derivatives of which Great Britain has always been an important supplier. As far as specialities are concerned, it is hoped to arrive at satisfactory arrangements of a cartel character with foreign suppliers in order to avoid wasteful and ruinous competition, especially in products the producing capacity of which has greatly increased during the war. Such cartel arrangements would, however, require official sanction, not only by the British authorities which may take a more critical view of agreements between competing producers than in the past, but also by the authorities of the importing countries if the impression of exploitation by a monopoly is to be avoided.

"—you have set up a record which is only to be broken"

—James Forrestal
Under Secretary of the Navy



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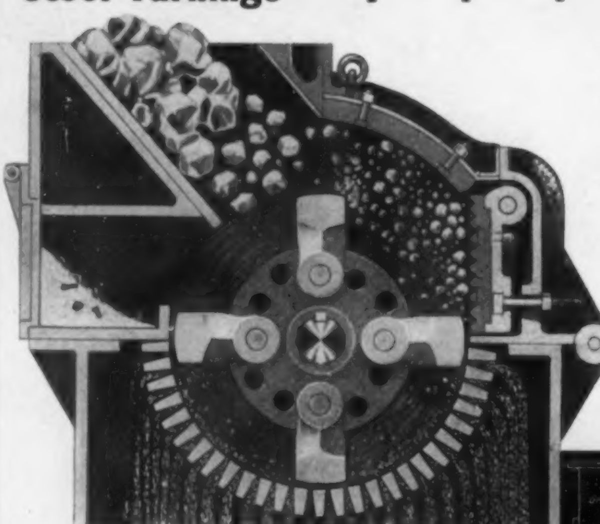
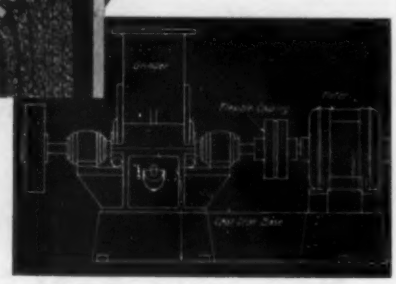


Sectional view of Williams over-running hammermill, with heavy liners and grinding plate for limestone and other hard material. Particular attention is directed to the grinding plate adjustment which assures uniform close contact of hammers and grinding plate at all times. Also note the metal trap which provides an outlet for the escape of tramp iron.



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SWEDEN PRODUCES ALUMINUM FROM ANDALUSITE

The Swedish aluminum plant, Svensk Aloxidverkin A/B, located of Kubikenborg on the Baltic coast, now produces aluminum by using andalusite as the basic raw material. Originally the plant was designed to produce only aluminum oxide. Operations were started in March 1942.

Between 8 and 10 metric tons of raw material is required to produce one metric ton of aluminum. Capacity of the plant has been placed at 6,000 metric tons of aluminum from andalusite, or 8,000 metric tons when bauxite is the basic raw material. Plans are to use bauxite when it again becomes available.

The plant, employing 250 persons, most of whom are former sawmill workers who have been retained, has been operating 24 hours daily. Annual production of 4,000 metric tons of aluminum is reported, including output of the Marsbo plant. These two plants are the only producers of aluminum in Sweden.

Despite the high impurity content of andalusite, it is claimed that the metal produced at Kubinkenborg is between 99.4 percent and 99.7 percent pure.

NEW CHEMICAL PRODUCTION FOR PORTUGAL

Sociedade Argicola e Industrial de Productos Quimicos has received permission to establish a factory in Portugal for the production of sodium sulphite, sodium bisulphite, sodium hyposulphite, calcium bisulphite, and potassium metabisulphite.

The proposed plant will be located on the Tagus River, between Lisbon and Santarem, and, under the terms of the concession granted by the Government, it must be in operation before October 1, 1944.

Although the entire personnel is required to be Portuguese, special provisions have been made to permit the employment of foreign technicians during the period of installation.

SCARCITY OF SALT REPORTED IN BRAZIL

The government of the State of Sao Paulo is taking steps to meet a serious shortage of salt in that State.

Salt will be imported from Argentina, its production by evaporation will begin at Santos, and larger supplies are to be obtained from the salt pans at Cabo Frio in the State of Rio de Janeiro. In this connection, the National Salt Institute has agreed to remove the provision restricting salt production in Rio de Janeiro to the period between September and April and has requested salt producers to step up their output to a maximum.

CHILE WILL MINE SULPHUR

Application has been made for permission to exploit a sulphur deposit near Loncoche, in the Province of Cautin, the Chilean press announces. Work is expected to commence in the spring.

SELECTIONS FROM FOREIGN LITERATURE

CATALYSTS FOR MANUFACTURE OF CARBON BISULPHIDE

REACTIVITY of carbon materials used in the manufacture of carbon bisulphide can be increased by more than 30 percent through the use of certain sodium and potassium salts as catalysts.

Carbons used in the experiments were birch charcoal, prepared from birch wood by heating it in a crucible furnace at 800 deg. C. for three hours, and peat coke and anthracite coal which had been similarly treated. The yield of carbon bisulphide from the reaction of the sulphur fumes and carbon increased with the temperature up to a maximum of about 1,000 deg. C. The anthracite was found to be very unreactive as compared to the other carbons. It was, in fact, only about 50 percent as reactive as birch charcoal at 900 deg. C.

Among all the salts added as catalysts, only those of potassium and sodium increased the reactivity of the carbons. Some compounds, such as those of calcium and copper, had no effect and others, such as nickel, iron and particularly silicon dioxide, actually slowed down the reaction rate. Sodium carbonate, sodium sulphate and sodium hydroxide were the most effective sodium catalysts. Their catalytic action on formation of carbon bisulphide is apparent between 700 and 1,000 deg. C. The optimum quantity of sodium carbonate that should be added is 3-4 percent, while that for sodium sulphate is approximately 5-6 percent. All experimental results have been confirmed on a plant scale basis.

Digest from "Catalysts for the Formation of Carbon Bisulphide from its Elements" by L. J. Markovski and N. Khorosbkova, *Zhurnal Prikladnoi Khimii* XV, No. 5, 290–301, 1942. (Published in Russia.)

DEFECATION WITH PHOSPHATES

DEFECATION of sugar with lime and phosphoric acid results in a voluminous precipitate of calcium phosphate which absorbs a large part of the colloidal and suspended impurities. This precipitate is, however, difficult to eliminate as it forms a gelatinous layer which slows up filtration.

Work on this problem has shown that the structure of calcium phosphate in an aqueous solution varies with the concentration of phosphate. These experiments were carried out on syrups containing 300 g. of sugar in 200 cc. of water, filtered at a temperature of 90 deg. with 0.5 g. of kieselguhr through a Buchner funnel under constant pressure. The pH was maintained at 6.8 and the phosphate was 0.1 percent of the sugar. Check experiments with refined sugar showed that impurities in the sugar had no effect on the filterability of the calcium phosphate.

This work led to the conclusion that the poor filterability of calcium phosphate in sugar syrups is due to the

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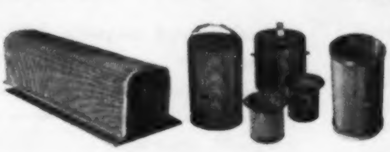

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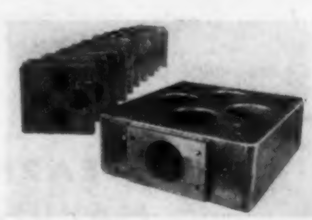

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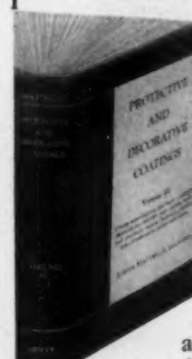
Edited by Joseph J. Mattiello



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voluminous structure of the precipitate when it is formed in solutions of low phosphate concentration, as is commonly the case in the sugar industry, and to the presence of sugar during the precipitation. Calcium phosphate precipitated in an aqueous solution of high phosphate concentration was crystalline and filtered readily.

Experiments were conducted substituting other alkaline earths for calcium. For example, 4 cc. of calcium phosphate solution (40 g. per l.) were added to the syrup and neutralized with aqueous suspensions of the hydroxides of calcium, barium, strontium and magnesium, respectively. The accompanying table shows the time of filtration in each case.

Precipitant	Time Required to Filter 400 cc., sec.
Calcium hydroxide........	180
Barium hydroxide.........	160
Strontium hydroxide.......	120
Magnesium hydroxide.....	60

Although the magnesium phosphate precipitated in solutions of low phosphate concentration and in the presence of sugar is of superior filterability, its decolorizing power is inferior to that of calcium phosphate.

Digest from "Studies on Defecation with Phosphates," by Kurt Loewy. *Revista Brasileira de Quimica* XV, No. 86, 105–106, 1943. (Published in Brazil.)

SULPHURIC ACID FOR ANODIC OXIDATION OF ALUMINUM ALLOYS

Although the chromic acid method for producing a protective film on aluminum alloys by anodic oxidation is the one most widely used in Soviet Russia today, the sulphuric acid method is beginning to gain considerable favor since it has numerous advantages over the chromic acid process.

Protective qualities of films obtained by the sulphuric acid method are considerably better than those obtained from chromic acid, requiring less protection from varnishes. The films also have a better adhering quality. Sulphuric acid is the cheapest of the three electrolytes (chromic, sulphuric and oxalic acids) industrially applicable for this process. The use of sulphuric acid involves less spoilage and corrosion of the anode material. It can be used for the anodic oxidation of every type of aluminum alloy used in the airplane industry. Operation with this acid is simpler, the process requires 30-50 percent less electric current and fewer precautions against gases and corrosion in the plant are necessary.

Considerable new work has been done which has resulted in the improvement of the sulphuric acid process and a 50 percent reduction in the time of operation. The quality of the film can be kept constant or changed at will and its elasticity can be tested by means of a new apparatus. Solubility of the aluminum in the bath can be computed with satisfactory precision from the change in weight of the sample during the process of anodic oxidation by using the formula,

$$q = 4.23a - 0.53p$$

in which q is the grams of aluminum

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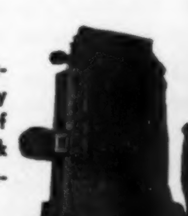

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dissolved during the anodic oxidation process, a is the total amount of faradays of electricity used, and p is the change in weight of the sample observed during the process, expressed in grams.

Digest from "Development of an Accelerated Method for the Anodic Oxidation of Aluminum Alloys in Sulphuric Acid," by G. B. Akimov, N. D. Tomashov and M. N. Tiukina, *Zhurnal Obschei Khimii* **XII**, No. 11–12, 568–584, 1942. (Published in Russia.)

BRAZILIAN SUBSTITUTE FOR GUM LAC

A SUBSTITUTE for imported gum lac has recently appeared on the Brazilian market. This product is made from material extracted from the pine nut. The attached table shows its physical and chemical properties as compared to the imported gum lac commercially known as "Orange Shellac 70-T.N."

It was found in tests that the Brazilian product could produce a more brilliant varnish than the orange shellac and that it could easily replace the imported product provided its penetrability could be decreased and its hardening time shortened so that a harder film would be formed. When applied to hard, non-porous woods the behavior of the Brazilian product is very similar to that of orange shellac. It is also applied in the same manner, except in the case of porous woods such as cedar which involves some difficulties.

In its present marketed form, the Brazilian product does not yet have all the properties of a complete substitute for the imported product in the preparation of wood varnishes with an alcohol base. When it is used as 50 percent of the raw material, however, it can be applied with satisfactory results for the same purposes as the imported gum lacs.

Digest from "National Substitute for Gum Lac," by Sylvio Ferreira Veiga, *Revista de Quimica Industrial* **XII**, No. 132, 22–23, 1943. (Published in Brazil.)

Properties of Brazilian Substitute for Imported Gum Lac

Physical Properties	Brazilian Product	Orange Shellac 70-T.N.
Density at 20 deg. C	1.243	1.110
Melting point, deg. C	105	95
Solubility in ethyl alcohol	Soluble	Soluble
Viscosity at 24 deg. C	0.766	0.830
Resistance to humidity, 24 hr. in the cold	Clouds up	Does not cloud up
Heated for 15 min	Clouds up	Clouds up
Time of clouding in the cold, ½ percent solution NaOH	Instantaneous	3 min.
Time of clouding in the cold, ½ percent solution H_2SO_4	15 min.	150 min.
Time of gelatinization at 150 deg. C. (Heat Brown Test)	Did not gelatinize after 607 min.	Gelatinizes in 28 min.
Chemical Properties		
Acidity index	21.88	70.31
Saponification index	156.50	241.65
Ester index	134.62	171.34
Iodine index (Wijs method)	26.92	41.02
Impurities, insol. in alcohol when heated, %	1.7	1.60

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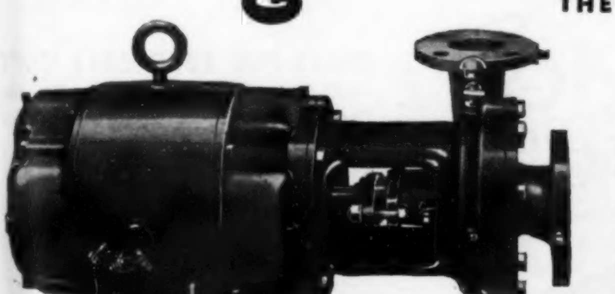

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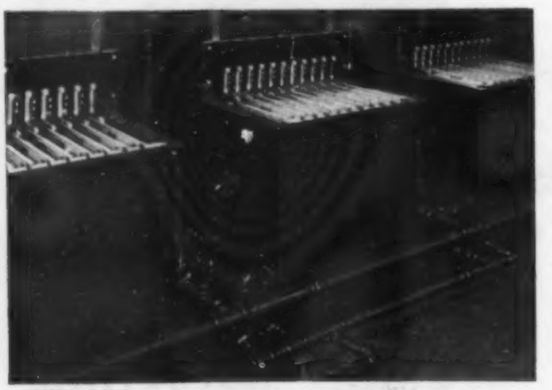

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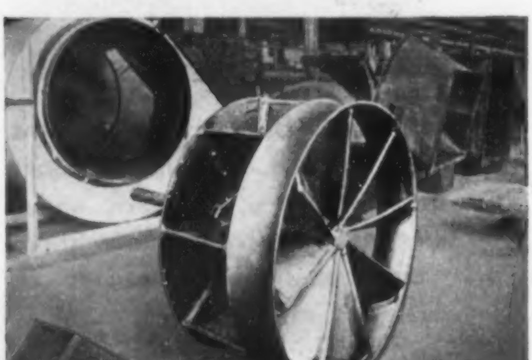

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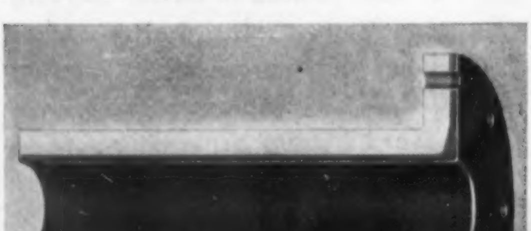

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MANUAL OF INGREDIENTS

PAINT LABORATORY NOTE BOOK. By J. S. Remington. Published by Chemical Publishing Co., Brooklyn, N. Y. 138 pages. Price $2.75.

Reviewed by J. J. Mattiello

THE Paint Laboratory Note Book, compiled by John Stewart Remington, is a compact and handy little manual in which the ingredients of protective coatings are conveniently arranged under White Pigments, Colored Pigments, Oils and Thinners, and Synthetic Resins, each section including a number of tests. There is also a Miscellaneous section full of useful data and information on apparatus used in testing.

The arrangement by which quick and accurate test methods for paint materials are readily available, without the necessity of wading through a mass of irrelevant printed matter, is the chief thing the author has achieved. He proves himself well acquainted with the testing phases of work-a-day paint laboratory problems.

Another thing for which the average paint technician will be grateful is the simplification of the calculations. Even an expert may become rusty on calculations that he does not use every day, or perhaps has not even seen since he took his undergraduate courses.

Perhaps it should be mentioned that on page 79 the weights are given in Imperial pounds, and the American chemist should be prepared to make adjustments. In a future edition it might be well to include both Imperial and American pounds.

Many useful hints, chemical tables, and descriptions of various pieces of testing apparatus contribute to make this book a valuable tool for the paint technician. But its principal recommendation is its compact and convenient arrangement, which should prove a boon to the practical paint chemist.

TEMPORARY EXPEDIENTS

SUBSTITUTES. By H. Bennett. Published by Chemical Publishing Co., Brooklyn, N. Y. 225 pages. Price $4.

Reviewed by C. L. Mantell

THE SUB-TITLE of the book is "A Handbook of Substitutes and Alternatives for Chemicals, Metals, Fibers and Other Commercial Products Including a Plan for Making a Proper Choice." The author is the Technical Director of Glyco Products Co., Inc. and the Editor-in-Chief of The Chemical Formulary.

The introduction to the subject covers three pages, a discussion of substitute requirements and the variables involved covers 47 pages, the list of substitutes themselves covers 158 pages, and the index some 23 pages, making 225 pages in all,—truly a compact and concise compendium if the author has achieved the sub-title. This reviewer had the reaction that the volume was too elementary to be of use to the practical chemist, the works manager, or the competent technician in a manufacturing industry. In that "a little knowledge is a dangerous thing," the volume would be decidedly misleading and confusing to a purchasing agent or those not technically or scientifically trained who were searching for information.

The aim of the volume is definitely commendable and would satisfy a current need, but in this writer's opinion it has "missed the bus."

MANUFACTURE AND APPLICATIONS

PROTECTIVE AND DECORATIVE COATINGS. Vol. III. By Joseph J. Mattiello. Published by John Wiley & Sons, New York, N. Y. 830 pages. Price $7.50.

THIS is the third volume in a series of four books. It covers the manufacture and application of colloids, oleoresinous vehicles and paints, water and emulsion paints, lacquers, printing inks, luminescent paints, and stains. The principal direction of this volume is to those students who look to it for guidance and information, and to the paint industry as a whole.

Basic principles have been stressed: they provide a groundwork for the serious student from which he may branch off on new developments of his own.

To encourage initiative, experiment and the exercise of native shrewdness and ingenuity, formulations have been kept to a minimum They are not intended to be the last ones, or the only ones, for the purpose in question, whatever it happens to be. They are given as a guide and as a basis for discussion.

With this general, comprehensive, and organized body of knowledge, the technical men in the industry will be able to depend on these volumes for reference and guidance for many years.

CHARTS AND TABLES OF DATA

COPPER AND COPPER BASE ALLOYS. By R. A. Wilkins and E. S. Bunn. Published by McGraw-Hill Book Co., New York, N. Y. 355 pages. Price $5.

Reviewed by S. Skowronski

AS STATED by the authors the data presented in this book has been compiled for the purpose of rending readily available reasonably complete engineering data on each of the many alloys of copper that are of commercial significance, and except where otherwise noted are based on tests conducted by the Research and Development Department of the Revere Copper and Brass Incorporated.

The book represents an enormous amount of work, the descriptive matter has necessarily had to be limited and the properties of copper and its major alloys are shown in a series of 127 tables and 860 charts. The charts are of uniform size, well drawn, easily read and fully cover the properties of the various alloys.

The various properties of copper and its major alloys are covered in eleven chapters, and three additional chapters take up mechanical properties at low temperature, fatigue and corrosion-fatigue properties, and bending properties. Two brief appendices give methods of tests followed by the authors, and definitions of terms used in the book. The book is well indexed which is a necessity in this type of book.

The authors are to be congratulated on an excellent book which has long been needed by the copper industry, and its publication at this time is particularly timely, but since most of the data given is new, some of it is controversial in nature. With the mass of figures given in the book, some typographical errors are bound to occur, a most serious one is in Table 1 where the copper content of tough pitch copper is given as 99.03%.

The book in its size, binding, and printing follows the style of "International Critical Tables", and the publishers are to be commended for keeping the book reasonably priced.

WITH AUTHENTIC PATINA

TREATMENT OF EXPERIMENTAL DATA. By A. G. Worthing and Joseph Geffner. Published by John Wiley & Sons, New York, N. Y. 342 pages. Price $4.50.

Reviewed by Dale S. Davis

NOVELISTS, just now, seem to be striving as never before to turn out material which shall be as obscure as possible. Many attain passages, even whole chapters, of vague, evanescent vaporings

---

RECENT BOOKS RECEIVED

The Chemistry of Powder and Explosives. Vol. II. By T. L. Davis. Wiley. $3.

So You Want to be a Chemist. By H. Coith. McGraw-Hill. $1.50.

Noxious Gases. 2nd. ed. By Y. Henderson & H. W. Haggard. Reinhold. $3.50.

Fundamentals of Engineering Drawing. By W. J. Luzadder. Prentice-Hall. $4.

Secretary to the Engineer. By Q. Hazleton. McGraw-Hill. $1.75.

Chemical Spectroscopy. 2nd ed. By W. R. Brode. John Wiley. $7.50.

The Chemistry of the Aliphatic Orthoesters. By H. W. Post. Reinhold. $4.

Organic Syntheses. Collective Vol. II. Ed. by A. H. Blatt. Wiley. $6.50.

An Outline of the Chemistry of the Carbohydrates. E. F. Degering. Swift. $4.

Cellulose and Cellulose Derivatives. Ed. by E. Ott. Interscience. $15.

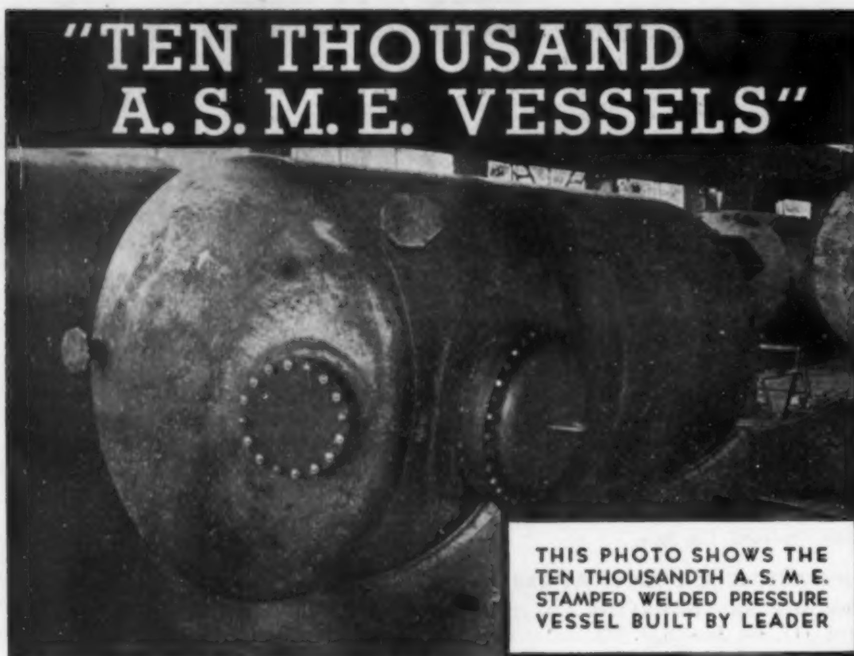
Tungsten. By K. C. Li & C. Y. Wang. Reinhold. $7.

Patent Law. By C. H. Biesterfeld. Wiley. $2.75.

Electronic Interpretations oof Organic Chemistry. By A. E. Remick. Wiley. $4.50.

Chemistry Made Easy. By C. T. Snell & F. D. Snell. Van Nostrand. $7.95.

Structure of Metals. By C. S. Barrett. McGraw-Hill. $6.



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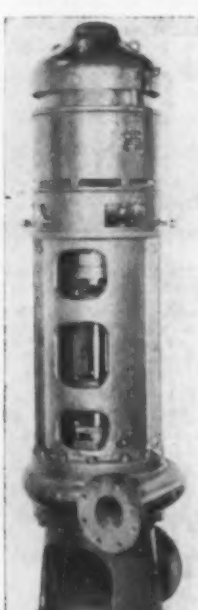

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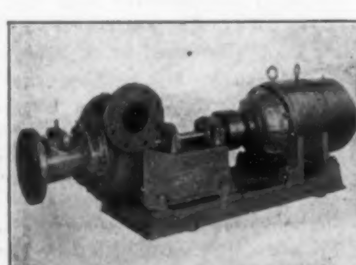

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which carry no meaning whatever. If you, too, are heartily sick of the situation and are driven to the technical literature to find something you can understand, something tangible of immediate utility, seek sanctuary between the bright green covers of Worthing and Geffner's eminently lucid and practical text! Deeply rooted in honest, four-square mathematics the book bears the authentic patina of successful application, on the part of the authors, in the classroom and industrial laboratory.

It stems from the senior author's repeated impatience with fuzzy thinking and inadequate—even misleading—presentation too frequently encountered in the published and unpublished work of physicists, chemists, and engineers. The book is the outgrowth of a graduate course offered at the University of Pittsburgh.

For years your ruffled reviewer, now calming down somewhat, has castigated, in class, a text on a related subject with, "Gentlemen, this book by X and Y is so muddled and difficult that no one can understand it but X and Y themselves—and there's some doubt about X." Joint efforts are like that sometimes but that isn't the way Worthing and Geffner collaborate. They understand the power and nuances of their subject and they understand, too, how to present it with crystal clarity. Adopting much the technique of the colored preacher who revealed the secret of his evangelical success with "First I tells 'em what I'm *going* to tell 'em, then I *tells* 'em, and then I tells 'em what I *told* 'em" the authors lure the reader into each chapter with a titillating introduction and reward him with a gratifying summary at the end. In between he will find adventurous, exciting material nicely broken with adequate sub-heads and supplemented with excellent cuts, illustrative examples and good sound problems, properly documented, and drawn largely from the field of physics.

The thirteen chapters deal with representation of data by tables, graphs, and equations, tabular and graphical differentiation and integration, Fourier series, normal frequency distribution, means and precision indices of unequally weighted measurements, the propagation of precision indices, the adjustment of conditioned measurements, least squares, correlation and the analysis of non-harmonic periodic functions. In the appendix there's a splendid discussion of determinant methods with which most engineers are insufficiently familiar and good tables of probability coefficients and integrals, Chauvenet's criteria, correlation coefficients, least squares constants for use with abbreviated methods, logarithms to the bases *e* and 10, square roots, and trigonometric functions. The bibliography of eight pertinent fields of interest is most useful and the indexing is well-done.

In the event of a second edition perhaps the authors can be prevailed upon to add more problems to the chapter on empirical equations, to include a section on dimensional analysis written in their best manner, and to dismiss nomography (p. 37) a little less abruptly. One can

chuck a rock anywhere, these days, and hit a better example of a nomographic chart than Fig. 9, p. 40, but the reviewer recovered his good humor long before reaching Chapters XI and XII which deal so well with least squares and correlation coefficients.

"Treatment of Experimental Data" is well adapted to classroom use and to individual study by chemists, engineers, and others who can still use their mathematics. It is characterized by lucidity of presentation, practicality of application, and exceptional freedom from annoying, misleading errors in theory and typography. The binding and mechanical make-up match the excellent collaborative work of a professor and practicing engineer.

FERROUS AND NON-FERROUS

STANDARD METAL DIRECTORY, 1943 Edition. Published by Atlas Publishing Co., New York 11, N. Y. 705 pages. Price $10.

THE NINTH edition of the directory is the first published since 1940. The main section covers iron and steel plants, ferrous and non-ferrous foundries, smelters, mills and fabricating plants. New lists added include fabricators of steel products, airplane manufacturers, and merchants specializing in steel products.

TEXTBOOK

ESSENTIALS OF COLLEGE CHEMISTRY. By Norman Kharasch and Helen S. Mackenzie. Published by D. Van Nostrand Company, New York, N. Y. 513 pages. Price $3.50.

Reviewed by R. E. Kirk

THIS textbook in College Chemistry written by two teachers at the Illinois Institute of Technology represents a somewhat unusual approach to the problem of a first year course in general chemistry in college.

It opens with an Introduction of 23 pages followed by a general section on the fundamental ideas of chemistry of 150 pages. There then follow sections on the Theory of Ionization—30 pages; the Non Metals—48 pages; Electrochemistry and Colloid Chemistry—38 pages; the Metals—52 pages; Carbon and Carbon Oxides—11 pages; Introduction to Organic Chemistry—83 pages; the Ceramic Industries—20 pages; and an Outline of the History of Chemistry offered as an Appendix—17 pages. One outstanding innovation is the large amount of space devoted to Organic Chemistry—approximately one-sixth of the textual material. This section is unusually good. Indeed, there is as much factual material in it as is contained in many introductory courses in organic chemistry, together with a number of interesting items of applied organic chemistry. For example, one finds a three-page summary of the Chemistry, Functions, and Sources of the Vitamins.

However, many other sections are distinctly below the section on organic chemistry and the treatment in these is necessarily very inadequate because of the severe limitations of space. One finds, for example, no discussion what-

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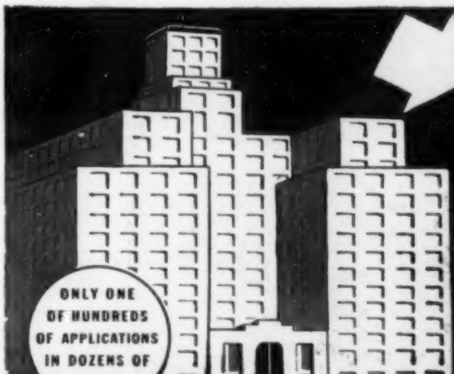

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ever of normal solutions and no distinction is made between acidimetric equivalents and oxidimetric equivalents. It seems unfortunate that only 11 pages can be devoted to the chemistry of sulphur, only 12 to the chemistry of nitrogen, only three to the chemistry of phosphorus and only 26 pages to the chemistry of the halogens. The very important topic of metals is covered in only 52 pages.

Minor mistakes include a statement repeated three times on the same page implying the non existence of monatomic molecules. In general, the ideas of ions seem to be kept in water-tight compartments in the book and no migration has been allowed into the other sections. This is not in accordance with modern practice in the teaching of general college chemistry.

FAIR WARNING

ENCYCLOPEDIA OF SUBSTITUTES AND SYNTHETICS. Edited by Morris D. Schoengold. Published by Philosophical Library, New York, N. Y. 382 pages. Price $10.

Reviewed by Jerome Alexander

THE PREFACE states: "The editor felt, however, that a mere listing of these substitutes (for hard-to-get materials) would be insufficient. He has gone further and has compiled an encycolpedia in which he has listed the materials and in addition has presented some of the chemical and physical properties of the materials and products." The jacket states that the book was prepared "with the collaboration of America's foremost chemical and industrial laboratories," and pp. 11–13 has a list headed "Acknowledgment of thanks is due to the following organizations which lent their assistance in the preparation of this volume." Besides the Bureau of Mines, National Bureau of Standards, etc., included under a separated heading of "assistance rendered," the list includes the names of a number of well known companies, who apparently furnished printed publications and sales information. A "blurb" on the turn-in of the jacket states: "An invaluable reference book prepared with the cooperation of the foremost chemical and industrial laboratories of the United States." This invocation of reputable names may, in the opinion of whoever wrote it, give the book an odor of scientific sanctity; but a reviewer must be impersonally critical and consider the book objectively.

Your reviewer estimates that by suitable choice of type and spacing, about half the paper in the book could have been saved. Apart from this woeful waste, about one third of the type space is taken up by multiple listings, which might have easily been handled in the Index. For example, about half of p. 186 is used to refer "Lanthana," "Lanthanum sesquioxide" and "Lanthanum trioxide" to "See Lanthanum oxide," and to state that this last is "a white powder; sp. gr. 6.41; soluble in acids; slightly soluble in water; Uses: Substitute for lime in calcium light."

About another third of the book is devoted to abortive descriptions of various

well-known chemicals and substances (which are much more extensively described in such books as Merck's Index or in chemical dictionaries), followed by listings of "Uses" and/or "Substitutes" in terms so general as to be of trivial use and apparently culled from claims printed in books and circulars. Thus under Platinum (p. 254) appears the following: "Uses: Catalyst. Laboratory wares of all kinds, Electrodes, wires, etc. · Industrial equipment. Jewelry, dentistry, electrical contacts, etc. Substitutes: Magnesium oxide. Molybdenum oxide. Molybdenum is a substitute for platinum in contact-making and breaking devices."

About another third of the book is devoted to listing and describing materials known by trade names, and an Index of Trade Names occupies pp. 363–372, including the firms that make or sell the products. The editor seems to think well of some of these materials, for they are liberally listed as being suitable substitutes for other materials.

A few items may be detailed: Page 19: "Acetic Acid (Methanecarboxylic acid, Vinegar acid) CH_3COOH. Used in the dyeing of wool and other processes. It may be replaced by solutions of ammonium sulfate and sulfuric acid, lactic acid and formic acid." This is the complete entry—but two entries, as per parenthesis, say: "See Acetic Acid." On page 63: "Brass. An alloy of zinc and copper with varying composition. Some lead or tin is at times included in the formulation. Small amounts of other metals are also added. . . . Brass plumbing has been replaced by glass plumbing. . . . Among other substitutes may be mentioned the following: Cast iron, silver plate, porcelain, plastics, enameled and plated steel, etc." On page 105: "Cotton Linters. Canada is rapidly attaining self-sufficiency in cotton linters. Canadian wood pulp is being utilized as a source of cellulose in place of imported cotton linters which was previously obtained from the United States." (That is all). And on page 259: "Potash. Potassium hydroxide is known to the trade as potash. The term is also applied to potassium carbonate, potassium oxide. The United States is practically independent of foreign sources for its potash supply. In England it has been suggested by the Ministry of Agriculture that common salt can be used as a substitute for potash as a fertilizer." (That's all). And on page 13 the U. S. Dept. of Agriculture, Bureau of Agricultural Chemistry and Engineering is cited for "assistance rendered"!

The paper and printing are poor, and quite a few typographical errors were noted. On the jacket, printed in lurid magenta, appears the following quotation: "A first rate job based on first hand information . . . not mere listings, but the whole story: Properties, Solubility, Substitutes, Uses, Processes. In these days of unforeseen difficulties and new problems, no chemist, research man or planning manufacturer should be without it. We recommend it highly. . . ." This is signed: "Dr. A. R. in *Science Illustrated*." The identity of this reviewer and the date of publica-

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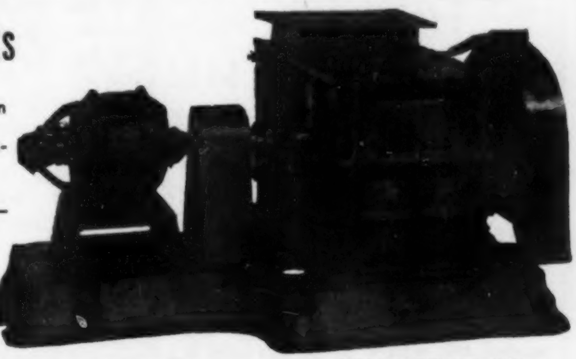

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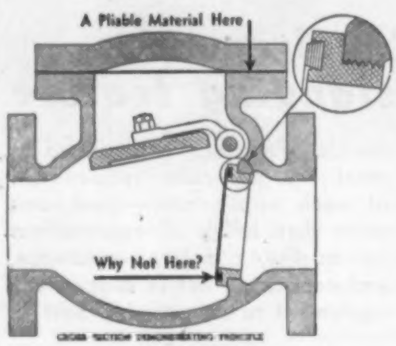

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tion of this review are not given; but despite the enthusiasm of Dr. A. R., your reviewer cannot recommend that anyone pay $10, or even any lesser sum, for this book.

LEATHER

THE PRINCIPLES AND PROCESSES OF LIGHT LEATHER MANUFACTURE. By Paul I. Smith. Published by Chemical Publishing Co., Brooklyn, N. Y. 408 pages. Price $6.50.

Reviewed by Fred O'Flaherty

OVER a period of some five to six years Mr. Smith published a series of articles in Hide and Leather. These were subsequently assembled into the present text in the same form. The entire book is based upon English tanning processes, but the only mention of this is a note by the editor, page 71. The author has much criticism of the present workings of leather chemists, the bulk of which has no application in America.

The author, while covering very superficially every phase of light leather manufacture, evidences a great lack of knowledge of scientific facts. This is especially noticeable in most references to microbiological applications.

References are given in most chapters, but in most instances, the more authoritative works are ignored.

This book may prove of general interest to American Leather Chemists, but its superficial nature and incompleteness do not lead one to confidence in any of the detailed processes it contains. It will in no way influence processing of leather in the United States.

PROTEIN SURVEY

PROTEINS, AMINO ACIDS AND PEPTIDES AS IONS AND DIPOLAR IONS. By E. J. Cohn and J. T. Edsall. Published by Reinhold Publishing Corp., New York, N. Y. 686 pages. Price $13.50.

Reviewed by F. C. Nachod

IN PREPARING this most complete survey of the field, the authors have been assisted by John D. Ferry, John G. Kirkwood, John W. Mehl, Hans Mueller, J. L. Oncley, George Scatchard and other associated workers.

The text is divided into two main parts: "Amino Acids and Peptides," and "Proteins." In the first part, the spectroscopy and dipolar ionic structure is discussed by Edsall, followed by thermodynamic treatment (Scatchard), acid-base equilibria, dielectric constants and dipole moments (Edsall), and chapters on activity coefficients of various amino acids by Cohn.

The second part covers such topics as X-ray diffraction and protein structure, discussions of virus proteins, rare amino acids, osmotic pressure and molecular weight, diffusion and sedimentation phenomena, and solubility studies.

The book is clearly written and the editors have coordinated the papers written by their collaborators in an admirable manner. Clarity in definition is inherent to the text. Two examples may illustrate this: The definition of dipolar ions (p. 2), substituting and replacing the terms Zwitterion, inner salt, double ion, amphoteric ion should

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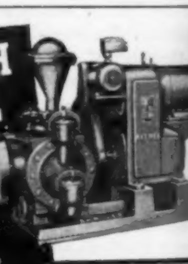

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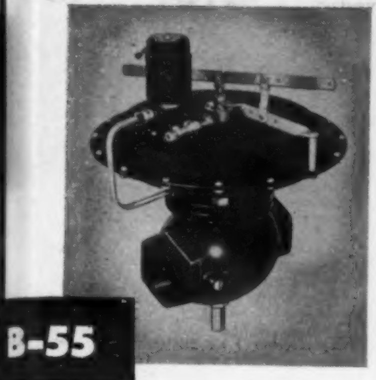

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form a sound basis for a uniform notation. The explanation of net charge and total charge of dipolar substances (p. 93) will be helpful to the reader who enters this section as a novice.

While the worker in the field will welcome this work as a much needed survey, the chemist not familiar with the protein field will find it interesting reading.

RECENT BOOKS and PAMPHLETS

Manual of A.S.T.M. Standards on Refractory Materials. Published by American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa. 201 pages. Price $1.50. Compilation of all A.S.T.M. standards on refractory materials with other pertinent information and data. Includes new standards for air-setting refractory mortars, fireclay plastic refractories, methods of tests for measuring shrinkage, spalling and workability index of fireclay plastic refractories, and a method for measuring the thermal conductivity of insulating fire brick.

Controlled Materials Plan. Published by Manning, Maxwell & Moore, Inc., Bridgeport, Conn. 12 pages. Prepared to assist key individuals in war industries and distributor organizations gaining a sound working knowledge of CMP.

Studies in Arc Welding. Published by the James P. Lincoln Arc Welding Foundation, Cleveland, Ohio. 1295 pages. Price $1.50. Contains 98 papers on arc welding submitted in the Foundation's recent Industrial Progress Award program. Contains a large amount of authentic arc welding design applications, together with welding data which may be translated into new applications.

Jobs and Security for Tomorrow. By M. S. Stewart. Pamphlet No. 84 published by Public Affairs Committee, Inc., 30 Rockefeller Plaza, New York 20, N. Y. 31 pages. Price 10 cents. Contrasts American emphasis on jobs in postwar thinking with the insurance approach contained in the British Beveridge Plan.

Renegotiation. Published by National Machine Tool Builders Association, Cleveland 6, Ohio. 23 pages. The Association believes that the procedure followed in renegotiation of war contracts is contrary to the national interests during either war or peace and is unnecessarily endangering the future existence of certain classes of business.

Handbook of Production Controls. Published by the Research Institute of America, 292 Madison Ave., New York 17, N. Y. 148 pages. How to operate under CMP scheduling priorities. Reprinted from the Business and Defense Coordinator.

Chemical Treatment of Cooling Water. By W. A. Tanzola. Technical Paper No. 85 published by W. H. and L. D. Betz, Philadelphia, Pa. 4 pages. A study of the problems encountered in cooling water system. Methods and commercial chemicals used for prevention of scale formation, corrosion and biological fouling reviewed.

Industrial Directory of South Carolina. Bulletin No. 5 (revised), compiled by South Carolina State Planning Board, Columbia, S. C. 187 pages. Records a total of 4,855 establishments. Revisions and additions have been made up to April 15, 1943. Industries are classified by products and by counties.

War-Time Worker's Handbook. By A. C. Croft. Published by National Foremen's Institute, Deep River, Conn. 28 pages. Prepared for distribution to employees by employers. A means to speed production and maintain harmonious labor relations.

A Nation Rebuilds. Published by Indusco, Inc., 425 Fourth Ave., New York 16, N. Y. 32 pages. Price 10 cents. The story of the Chinese industrial co-operatives.

The Production of Lump Charcoal from Pine Sawdust Without a Binder. By C. A. Basore and O. C. Moore. Engineering Bulletin No. 14. Published by Engineering Experiment Station, Alabama Poly-

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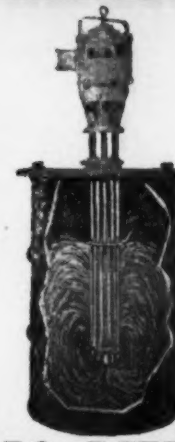

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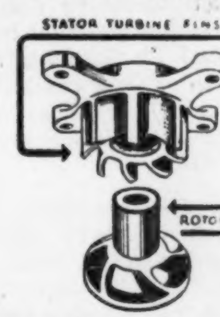

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technic Institute, Auburn, Ala. 32 pages. Report of an investigation to find a satisfactory method for the profitable disposal of the large amounts of finely divided wood wastes available in the South and West.

Tennessee—Land of Industrial Advantages. Published by Department of Conservation, Nashville, Tenn. 24 pages. An illustrated booklet which highlights the State's major industrial opportunities.

Bibliography of References to the Literature of the Minor Elements. Fourth supplement to the third edition. Compiled by L. G. Willis. Published by Chilean Nitrate Educational Bureau, New York, N. Y. 92 pages. Latest in a series of bibliographies on the relation of minor elements to plant and animal nutrition.

Engineering Index—58th Edition. Published by Engineering Index, Inc., 29 West 39th St., New York, N. Y. Price $50. Twenty-five thousand annotations of articles and 40,000 cross references.

Are You Overlooking Anything in your Post-War Planning? Published by Alfred J. Silberstein, 9 East 40th St., New York 16, N. Y. 27 pages. An advertising agency enumerates seven immediate benefits and six future benefits which every business can achieve by beginning now to plan its post-war operations.

Proceedings of the West Virginia Coal Mining Institute, 1941–1942. Published by West Virginia Coal Mining Institute, Morgantown, W. Va. 153 pages. Papers presented at the thirty-fourth and thirty-fifth annual meetings and the summer meeting of 1941.

Foremanship and Accident Prevention in Industry. Published by Engineering Department, American Mutual Liability Insurance Co., Boston, Mass. 94 pages. An aid in teaching foremen their responsibilities.

GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. In ordering publications noted in this list always give complete title and the issuing office. Remittances should be made by postal money order, coupons, or check. Do not send postage stamps. All publications are in paper cover unless otherwise specified. When no price is indicated, pamphlet is free and should be ordered from Bureau responsible for its issue.

First Aid Treatment for Survivors of Disasters at Sea. Bureau of Medicine and Surgery, Navy Department. Price 5 cents.

Shipyard Injuries and Their Causes, 1941. Bureau of Labor Statistics Bulletin No. 722. Price 10 cents.

Wage Structure of the Nonferrous Metals Industry, 1941-42. Bureau of Labor Statistics Bulletin No. 729. Price 10 cents.

Consumers' Cooperation in the United States in 1941. Bureau of Labor Statistics Bulletin No. 725. Price 10 cents.

A Handbook for Air Raid Wardens. Office of Civilian Defense. OCD Publication 1001-3. Price 10 cents.

Treatment of Burns and Prevention of Wound Infections. Revised April 1943. Office of Civilian Defense. OCD Publication 2203-1.

Plant Protection for Manufacturers. War Department Pamphlet No. 32-1. Obtainable from Internal Security Division, Office of the Provost Marshal General, Washington, D. C.

The Effect of Moisture Content on the Bursting Strength of Fiberboard. Revised May 1943. Forest Products Laboratory Technical Note Number 168.

Relative Slipperiness of Floor and Deck Surfaces. By Percy A. Sigler. Bureau of Standards Building Materials and

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Effect of Incentive Payments on Hourly rnings. Bureau of Labor Statistics, lletin No. 742. Price 5 cents.

Auditing Absenteeism: Absence Record rms in use by Representative Firms in r Industries. Division of Labor Stand-ds, Special Bulletin No. 12-A.

Federal Legislation, Rulings, and Regu-ions Affecting the State Agricultural periment Stations. Department of riculture, Miscellaneous Publication No. 5.

Methods of Analysis and of Reporting ber Composition of Textile Products. tional Bureau of Standards, Commer-l Standard CS65-43. Price 10 cents.

Mineral Wool; Loose, Granulated, or lted Form, in Low-Temperature Instal-lons. National Bureau of Standards, mmercial Standard CS105-43. Price 5 nts.

Earthenware (Vitreous-Glazed) Plumb-g Fixtures. Bureau of Standards, Com-rcial Standard CS111-43. Preliminary, meographed.

Adsorbent Clays, Their Distribution, operties, Production, and Uses. By P. Nutting, Geological Survey Bulletin 8-C. Price 20 cents.

Stream-Gaging Procedure. A Manual scribing Methods and Practices of the ological Survey. By Don M. Corbett d others. Geological Survey Water-pply Paper 888. Price 65 cents.

Explosion Hazards of Combustible esthetics. By G. W. Jones, R. E. Ken-dy, and G. J. Thomas. Bureau of ines, Technical Paper 653. Price 15 nts.

Annual Report of Research and Tech-logic Work on Coal, Fiscal Year 1942. A. C. Fieldner and W. E. Rice. Bureau Mines, Information Circular. I. C. 7241. meographed.

Stenches for Emergency Warnings in etal Mines. By D. Harrington and J. East, Jr. Bureau of Mines, Informa-n Circular. I. C. 7246. Mimeographed.

Cooperative Fuel-Research Motor-Gaso-e Survey, Winter 1942-43. By A. J. raemer and O. C. Blade. Bureau of ines, Report of Investigation. R. I. 3716. imeographed.

Experimental Chemotherapy of Burns d Shock, III. Effects of Systemic herapy on Early Mortality. By San-rd M. Rosenthal. Public Health Re-rts. Reprint No. 2467. Price 5 cents.

Gasproof Shelters. War Department, echnical Manual, TM 3-350. Price 15 nts.

Decontaminating Apparatus M3A1. ar Department, Technical Manual TM3-1. Price 60 cents.

Classification Bulletin of the United ates Patent Office From July 1, 1942 December 31, 1942. Document No.

Pricing in War Contracts. War De-rtment, Army Service Forces Manual 801. Mimeographed.

Community Action for Post-War Jobs d Profits. Bureau of Foreign and omestic Commerce, Industrial Series No.

Report of the National Patent Planning mmission. House Document No. 239, th Congress. Price 5 cents.

Instructions for the Operation and aintenance of Electrical Measuring In-ruments. Bureau of Ships. Price 10 nts.

Instruction for the Operation, Care, and epair of Compressed Air Plants. Bureau Ships. Price 10 cents.

Statistics of Income for 1940—Part 1, ompiled from Individual Income and De-nse Tax Returns, Taxable Fiduciary come and Defense Tax Returns, Estate ax Returns, and Gift Tax Returns. ureau of Internal Revenue. Price 30 nts.

Standard Commodity Classification Vol. Standard Classified List of Commodi-es. War Production Board, Technical aper No. 26. Price $1.25.

Census of Agriculture, Vol. III, General eport, Statistics by Subjects. Bureau of e Census. 16th Census of the U. S.: 40. Price $3.00, Cloth.

Statistics of Railways in the United ates, for the Year Ended Dec. 31, 1941. terstate Commerce Commission. Price .75, Cloth.

Statistics of Class I Motor Carriers, for e Year Ended Dec. 31, 1941. Interstate mmerce Commission, Statement No. 30. Price 50 cents.

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MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and executives, manufacturers usually specify that requests be made on business letterhead.

Turret Lathes. South Bend Lathe Works, South Bend, Ind.—Catalog 901—12-page booklet describing and illustrating this concern's line of Series 900 and Series 1000 turret lathes designed for high-speed machining of small chucking and bar work requiring close tolerances. Well illustrated.

Synthetic Rubber Chemicals. Hercules Powder Co., Wilmington Del.—8-page preliminary report on the use of various chemical products from pine wood as softeners and tackifiers in the compounding of synthetic rubber. Includes tables that give properties and comparative values in a typical GR-S tread-stock formula of several naval stores chemicals. Includes comparative values on tack, plasticity, resilience, compression set, tear test, heat build-up, flex outgrowth and aged elongation for eight naval stores products.

Industrial Directory. South Carolina State Planning Board, Columbia, S. C.—Bulletin 5—187-page revised industrial directory of the State of South Carolina. Includes data on industries classified by products and by counties. Includes textiles and their products, forest products, chemical and allied industries, stone, clay and glass products, etc.

Rubber Gloves. The B. F. Goodrich Co., Akron, Ohio—Catalog Section 9035—4-page section dealing with this concern's industrial rubber gloves made by the anode process for depositing latex on a form. Discusses outstanding advantages of these gloves, describes briefly the anode process, and gives specifications. Illustrated.

Equipment. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—64-page annual review of the engineering progress made in th concern during the past year. Contai 212 drawings and photographs and exte sive engineering data in diagram and te form.

Infra-Red Heating. North Americ Electric Lamp Co., 1014 Tyler St., S Louis, Mo.—8-page pamphlet dealing wi infra-red ray drying and heating and t line of "Dritherm" infra-red ray carb lamps put out by this concern. Includ numerous diagrammatic drawings a price lists.

Fire Protection. Walter Kidde & C Inc., 140 Cedar St., New York, N. Y.—1 page edition of this concern's house orga "High Pressure" which deals with vario aspects of fire fighting with the use compressed gases. Well illustrated b photographic reproductions.

Fire Fighting. Walter Kidde & C Inc., Belleville, N. J.—36-page illustrat manual on how to teach fire fightin Gives simple instructions and illustrat fundamental facts about fires and the control. Also discusses briefly the usu varieties of extinguishers, including th concern's built-in carbon dioxide e tinguishing systems. Well organized a written in simple language.

Tower Packing. The United Stat Stoneware Co., 60 E. 42nd St., New Yor N. Y.—Bulletin 61—16-page booklet dea ing comprehensively with tower packin of various types. Illustrates and giv advantages, outstanding features, and a plications of the various types of packin Contains numerous engineering charts a tables with dimension data.

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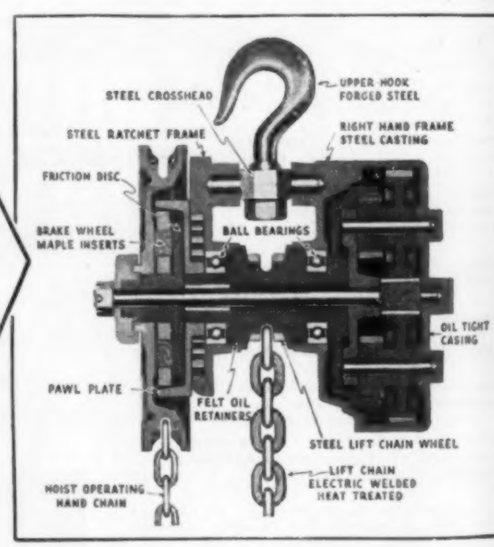

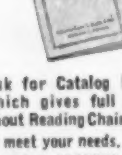

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Inc., 295 Madison Ave., New York, N. Y. Bulletin outlining fundamental principles in the use of "Witcogum" chemurgic rubber developed by this concern's research laboratories. Contains a summary of physical properties, compounding principles, processing procedure, and use of the material as an extender with rubber, reclaim and synthetics. Includes a number of charts and tables.

Open Steel Flooring. Walter Bates Co., Inc., Joliette, Ill.—Catalog 4344—16-page catalog on this concern's line of open steel flooring and stair treads of various design. Contains numerous installation photographs and brief descriptive material. Contains a table of safe loads for open steel flooring.

Pre-Paint Treatment of Metals. American Chemical Paint Co., Ambler, Pa.—Technical Service Sheet 725—4-page form dealing with this concern's "Lithoform" material for making paint stick to galvanized iron and other zinc or cadmium surfaces. Gives briefly the advantages of treating metal with this material before painting, directions for applications, and a list of other products put out by this concern.

Compressors. Worthington Pump & Machinery Corp., Harrison, N. J.—22-page booklet entitled, "Plain Talks on Air and Gas Compressors," which gives useful engineering information on compression efficiency relative to heat of compression, efficiency as affected by valve slip and friction, effect of volumetric on horsepower, mechanical efficiency, and direct-connected motor-driven compressors. Well illustrated by photographic reproductions and diagrammatic drawings.

Arc-Welding Accessories. General Electric Co., Schenectady, N. Y. — Bulletin GEA2704C—36-page bulletin giving information on this concern's extensive line of arc-welding accessories, including chrome-leather, asbestos and flame-proofed-duck protective clothing for operators, sleevelets, ventilated helmets and head protectors, electrode holders, slag chippers, etc. Also listed are standard sets of welding accessories and renewal parts. Extensively illustrated. Contains numerous tables and price lists.

Condenser Tubes. Bridgeport Brass Co., Bridgeport, Conn.—112-page condenser tube manual intended as a compact ready-reference on tubes used in condensers, heat exchangers and evaporators in power plants, oil refineries and process industries. Deals with new corrosion-resistant alloys put out by this company, and corrosion research covering the effects of electro-chemical theory of corrosion, types of protective films, impingement corrosion, etc. Well illustrated and full of useful engineering data.

Plastics. Rohm & Haas Co., Washington Square, Philadelphia, Pa.—91-page booklet giving technical data on "Plexiglas". Includes data on hardness, strength, modulus of elasticity, cold flow and applications of specific properties. Describes test methods and includes an appendix covering optical, electrical, and chemical properties of this concern's cast acrylic sheets. Contains numerous illustrations and extensive engineering data.

Laboratory Furniture. Laboratory Furniture Co., Inc., Long Island City, N. Y.—Catalog 43—224-page bound book illustrating, describing and giving specifications and dimensions of the line of laboratory furniture put out by this concern. Includes industrial tables, storage cabinets, fume hoods, sinks, educational tables, etc.

Lead Plating. The Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio—eight-page folder giving suggested uses, solution preparation, equipment, procedure, and methods of analyzing for lead plating with this concern's fluoborate lead solution concentrate. Contains useful engineering and operating notes.

Heat Transfer. Young Radiator Co., Racine, Wis.—Catalog 143—8-page folder illustrating and describing briefly the line of heat transfer equipment for various applications put out by this concern. Extensively illustrated.

Zeolites. Cochrane Corp., Philadelphia, 32, Pa.—Reprint 27—six-page reprint entitled "Predictable Results from Use of Carbonaceous Acid-Regenerated Zeolites." Presents useful data on characteristics of these newly-developed zeolites. Covers a series of tests giving research data.

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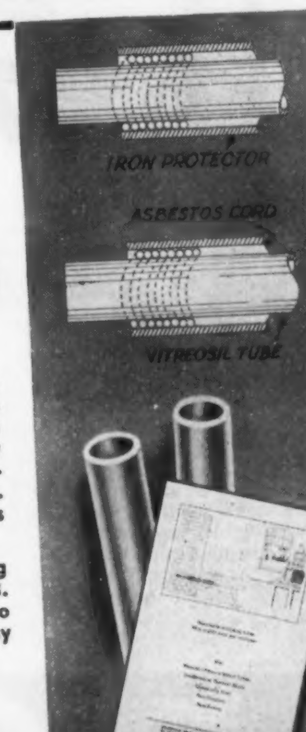

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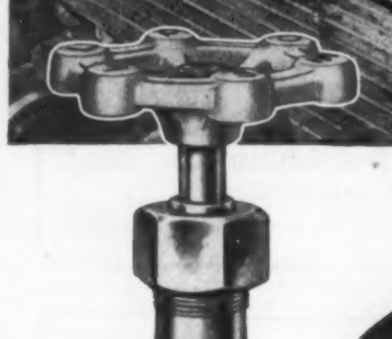

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ECONOMICS AND MARKETS

ENLARGED OPERATIONS AT REFINERIES AND GLASS AND STEEL PLANTS INCREASES DEMAND FOR CHEMICALS

With three-quarters of the year completed, statistics show that industrial consumption of chemicals has been maintained at a rate a little higher than was the case in 1942. Combined industry totals for the quarters of the year bear out the contention that a fairly even schedule of operations has been in effect. For the nine months of this year, the *Chem. & Met.* index represents consumption of chemicals at 175 compared with 170 for the comparable months of last year. For the first quarter of this year, the index number is 173, for the second quarter 170, and for the third quarter 176. This indicates a fairly even level for consumption but does not mean that the various industries are stabilized but rather that lessened activities in some directions have been offset by increased rates of operation in other lines. Recently petroleum refining, glass, steel, and rayon have been on the up side and have kept a favorable total balance despite a falling off in activities at textile, leather, paint, and fertilizer plants.

For August, the index for consumption is 179.60 which reverses the movement in the preceding month when the number fell to 172.42, largely due to a drop in consumption of sulphuric acid at superphosphate plants. Last year the index numbers were 169.52 and 164.14 for August and July respectively. In August glass works made a notable showing with a record output of containers although the flat glass departments, particularly plate glass, are considerably below peak operations. Refining of petroleum also was on a broader scale with runs to stills breaking into new highs. While shortages in pulpwood are holding pulp mills from more active operation, the pulp and paper industry moved up somewhat from the lower level maintained in the preceding month. Steel production continues to climb and the output for the third quarter made a new record which means that the industry succeeded in meeting the additional requirements placed upon it. Rayon manufacturers are placed in the difficult position of trying to satisfy increasing demands from civilian and war-program sources. At present the outlook for filling all civilian needs is far from promising. The tire program calls for large amounts of rayon cord and while plant capacities will be enlarged a good part of the additional capacity will be given over to the production of cord.

The leather industry is hampered by a scarcity of the finished product and because imports of hides are not up to requirements. There are reports to the effect that some imports of hides from South America are to be shared with Great Britain. It also is reported that tanning operations and facilities in some outside countries notably Mexico have been extended and are causing a diversion of hides which otherwise would come to this country.

Starting with its report for September, the War Production Board made public the quantities of the various chemicals issued for civilian use under allocation orders. Formerly the chemicals thus allocated were reported only in terms of value and the new method gives a concrete idea of the industry requirements of various chemicals.

Although the supply of oils and fats has been controlled in such a way as to give preference to consumption in edible lines, it is now announced that soap makers are to be given additional amounts of these raw materials in order to increase the output of soap for civilian use. The new plan provides for an increase in the allowable use of fats and oils for manufacture of soap from 80 percent of the amount used in 1940–1941 to 90 percent for household packaged soap; 110 percent for industrial soap or soap used by such consumers as restaurants, launderies, hotels, etc.; and 150 percent for abrasive powders and pastes.

The overall effect of this program is aimed at giving a 28 percent increase in supplies for civilian use. The larger output of soap products naturally will call for a more extensive demand for chemicals and it is of interest to note that the ruling also calls for compulsory use of specified proportions of rosin and other extenders which should have a strengthening effect on values for rosin.

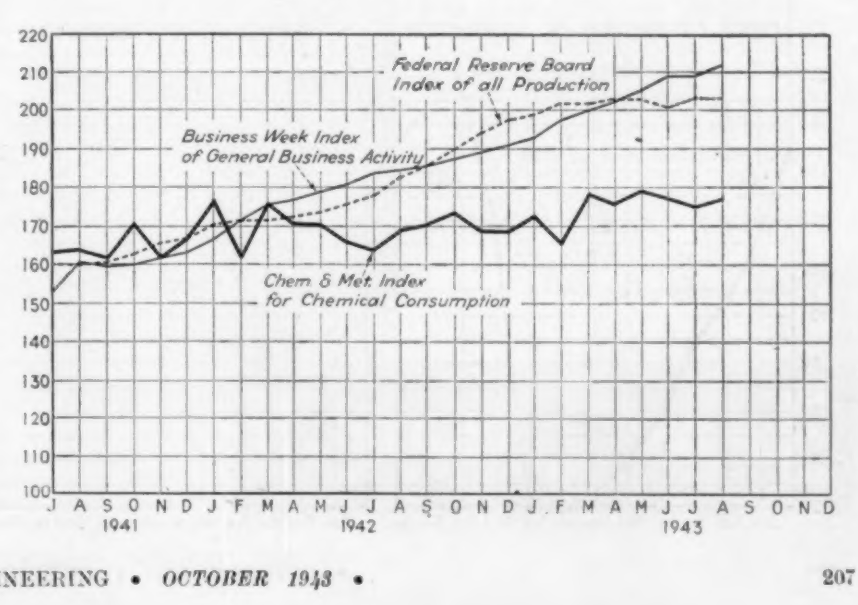
Factory consumption of oils and fats for the first half of this year fell off less than one percent from the total of 2,656,573,000 lb. consumed in the first half of 1942 but there was a marked change in the fields of consumption, as in the six-month period of 1942 about 37 percent of factory consumption went into edible lines while in the like period of this year, 53 percent went into edible products. On the other hand, the non-edible use of oils and fats in the same periods dropped from the 1942 total of 1,672,025,000 lb. to 1,236,604,000 lb. in the present year. The drop in the case of soap plants was especially sharp as this production in the first half of 1942 accounted for 1,012,249,000 lb. of oils and fats whereas 1943 requirements were only 804,276,000 lb.

Reflecting on the growth within the plastics industry, the Society of the Plastics Industry has just stated that production of plastic resins this year will total between 750,000,000 lb. and 800,000,000 lb. or almost double the output reported for 1941. The current year's production will be approximately sixteen times that of ten years ago. The most notable regional development in plastics production was made in California where the industry has expanded its capacity more than 500 percent in the last three years.

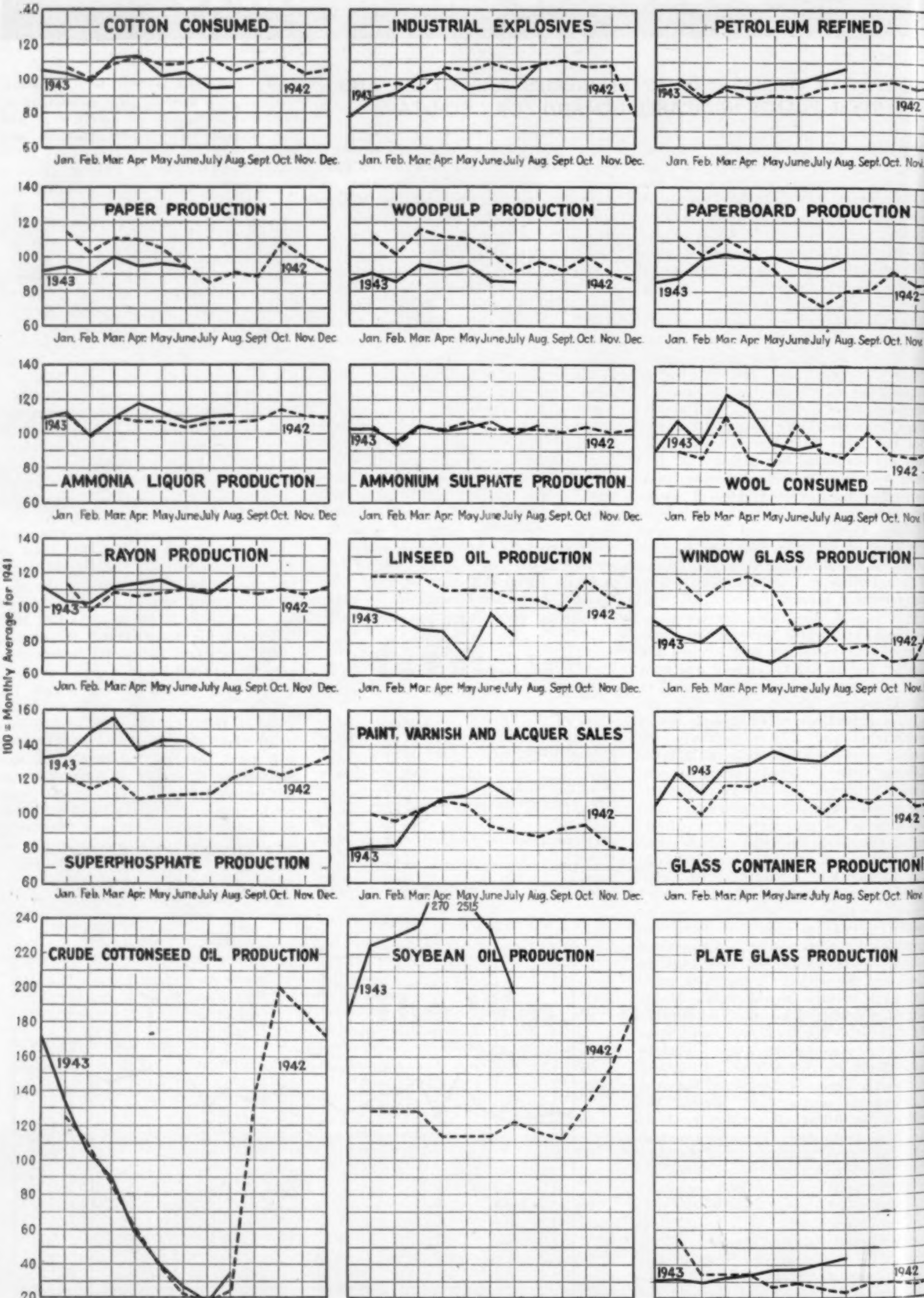
Chem. & Met. Index for Industrial Consumption of Chemicals

1935 = 100

	July revised	Aug.
Fertilizers	37.16	38.90
Pulp and paper	18.33	18.86
Petroleum refining	15.84	16.32
Glass	18.74	20.46
Paint and varnish	16.27	16.56
Iron and steel	13.51	13.71
Rayon	15.00	16.21
Textiles	10.74	10.88
Coal products	9.29	9.35
Leather	4.50	4.32
Industrial explosives	5.34	6.13
Rubber	3.00	3.00
Plastics	4.70	4.90
	172.42	179.60



Production and Consumption Trends



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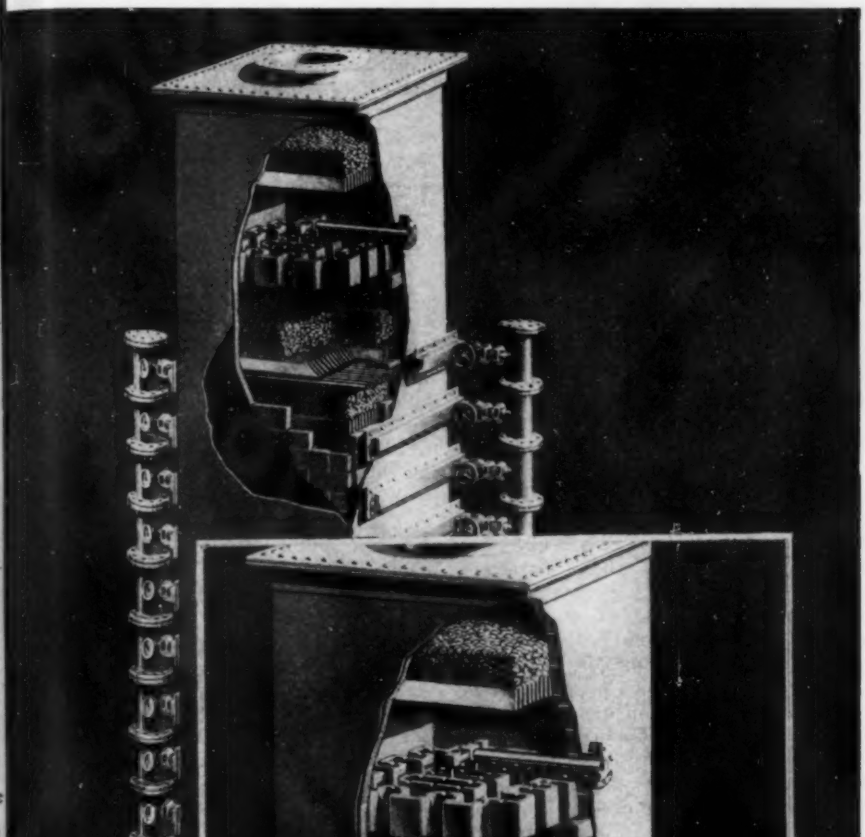
provide the strength of steel and the corrosion resistance of ceramics



The above Pyroflex Functional Unit is a muriatic acid absorption tower 6' by 5' by 33' high designed to have a capacity of 4,200,000 BTU per hour to produce 360 tons of 31% acid per day from 22% HCL gas.

DEVELOPED over 10 years ago, Pyroflex Functional Units provide corrosion-proof equipment beyond the size and service limits of chemical stoneware. A variety of tailor-made units, designed to do specific jobs, have provided the first satisfactory solution for many tough problems.

In essence, Pyroflex Functional Units combine the structural strength of steel or concrete with the positive corrosion resistance of ceramics, carbon or glass. Pyroflex itself is a thermoplastic sheet lining resin which acts as a bonding agent, an expansion cushion and a corrosion seal at the same time. We sell Pyroflex not by the sheet or pound but by the lining installed or the complete vessel.

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Among various types of Pyroflex equipment in service are the following: wood pulp chlorinator towers, electrolytic refining tanks, steel mill pickling tanks, electrolytic plating tanks, muriatic acid system coke boxes and gas cooling towers, acid boiling kettles, acid absorption and rectification columns, acid fume washers, acid storage and reaction tanks, floors, sewers, troughs and neutralizing collection basins.

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TRADING IN CHEMICALS IS RESTRICTED BY INCREASING CONTROLS OVER DISTRIBUTION

Among recent government orders which have a bearing on marketing and distribution was a modification of the order restricting the use of tapioca dextrine and other forms of tapioca flour. The use of tapioca in the textile field as a warp size had been prohibited except for synthetic fiber. The revised order makes similar exceptions in the case of warp sizes for combed cotton yarns 40 and finer and for cordage fibers. Tapioca is now prohibited as a finishing or loading material for all textiles except when Army or Navy specifications call for its use.

Primary chromium chemicals which have been well sold ahead for some time are now subject to allocation. There has been a continued heavy demand for chrome chemicals for dry chemical manufacture and other users have taken relatively large quantities although demand for bichromates for tanning has fallen off. Buyers for export have paid considerably above the contract level in order to get hold of bichromates.

Another ruling which may not prove to be so important as it sounds is concerned with the permanent types of antifreeze materials because of a revised order which states that these materials will be available for use in passenger automobiles beginning Oct. 1. It was pointed out that there had been no increase in the supplies of such materials but since operators of heavy vehicles would have first call on supplies up to October, it might be assumed that their requirements would be filled by that date and the surplus—if any—could be sold to owners of passenger cars.

In the solvents field, late changes are found in the case of acetone and diacetone which have been placed under allocation because of the sold-up condition of the market which was not helped by the temporary suspension of operations at two producing plants. Xylol is scarce with some comparatively new uses taking up a good part of offerings. With coal-tar solvents in very limited supply, there is a probability that toluol may be distributed more widely.

Interest in fertilizer chemicals has centered largely in nitrate of ammonia and nitrate of soda. In the case of the ammonia product the interest has asserted itself in the way of an increased demand. For some time complaints were heard regarding the use of this product for fertilizer purposes but with the preparation of a material suited for this industry, objections to its use seem to have been overcome. At least most recent reports say that buying orders have gained considerably in volume.

Fertilizer interests have been advocating steps looking toward a sharp rise in the tonnage of nitrate of soda to be imported into this country from Chili. It is now reported that arrangements have been completed for importing at least 700,000 tons in the current fertilizer year with a possibility that the amount will be extended to 1,000,000 tons. The only doubt regarding the carrying out of this arrangement seems to rest with the shipping situation or more precisely with the ability of shippers to obtain the tonnage necessary to move this large amount of nitrate.

The naval stores program is practically certain to be continued through next year on an unchanged basis. With labor scarce, especially in the woods, some fears are felt lest production fall below requirements. On that account and in order to stimulate a larger output, it may be that the benefit payments to producers will be increased from the present level of 1¾c. to 5c. a face to some higher range. In the meantime the market for gum rosins has been gaining in strength.

Materially lower freight rate surcharges on petroleum, petroleum products and other liquid cargo shipments into and between foreign areas were announced by the War Shipping Administration on Sept. 22, the reductions to become effective on that date. Fourteen of the new rate schedules apply to petroleum, two to liquid caustic soda, and one each to molasses, creosote, benzol, and liquid wax. A sharp cut was made in the rate on cargoes of petroleum from the Netherlands West Indies and U. S. Gulf ports to the Portland Pipe Line and to Halifax, N. S.

The creosote is carried from U. S. Atlantic ports to U. S. Gulf ports; benzol is transported from U. S. Atlantic ports to U. S. Gulf ports and between U. S. Pacific Coast ports; and caustic soda is carried between the Pacific Coast ports and in wing tanks from U. S. Atlantic ports to the Netherlands West Indies. Liquid wax is transported in wing tanks over sea lanes from U. S. Atlantic ports to the Netherlands West Indies. The order covering molasses applies to the route from the Hawaiian Islands to Pacific Coast ports.

With the majority of important chemicals under price control, there is not much leeway for variations in sales schedules. Among the developments of the last month was the placing of temporary ceilings for potassium chlorate produced and sold by new manufacturers. The ceilings will remain in force for at

CHEM. & MET.
Weighted Index of Prices for CHEMICALS

Base=100 for 1937

This month	**109.10**
Last month	109.03
October, 1942	109.3[illegible]
October, 1941	104.05

Prices for some chemicals in spot trading show a considerable spread over inside quotations but the bulk of tonnage business is going through at a steady price level. Price ceilings may be named on gum rosins.

least six months. The prices established are 10¾c a lb. for sales of 20 tons or more and range up to 12c a lb. for less than one ton. These prices are f.o.b. shipping point, containers included. In explanation, it was stated that the ceilings lower the prices of 18c to 30c a lb. which had been charged by small high cost California plants and one large scale producer in Oregon was affected whose prices were the same, with one exception as those established by the ceiling order. A new mid-western producer will produce more than the combined production of the small manufacturers and will be affected by the new regulation.

There is considerable speculation regarding future values for ethyl alcohol in view of reports that regular monthly shipments of molasses will again be made to this country and this will be used as a raw material for alcohol manufacture. It is held that this will necessitate some revision in the alcohol price schedule with lower production costs bringing the market more in buyers favor. Incidentally it was reported that there was a wide divergence in the views of sellers of molasses in Cuba and buyers in this country which might eliminate the Cuban supply from becoming a factor.

Prices for cotton linters were adjusted so that producers will receive the same return as they did for the 1942 crop. Maximum prices for chemical cordwood and chestnut cordwood were established for the purpose of increasing the supply and thus add to the volume of wood distillation chemicals as well as of tanning extract. Discussions between government and industry representatives have taken place regarding the possible placing of gum naval stores products under price ceilings. The market for rosins has been strong of late but handlers fear that price controls might affect work at primary points where scarcity of labor has been reported over a period of several months.

According to the Bureau of Agricultural Economics, lend-lease exports of oils and fats will go to larger volume in the next two years and will bring about higher prices for these commodities. This position is taken because of information which indicates a decline of nearly 50 percent in the oil and fat supply of Europe next year as compared with prewar standards.

CHEM. & MET.
Weighted Index of Prices for
OILS & FATS

Base=100 for 1937

This month	**145.55**
Last month	145.55
October, 1942	140.85
October, 1941	135.22

Stocks of all types of oil are small with some animal oils in an especially tight position. Prices are firm, generally at ceiling levels with intimations that the trend will be upward.

This is the reason

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★ In the process industries, close and exacting control of particle sizes in separation is all-important. The way the Whirlwind Centrifugal does this is simple—but it took over 20 years to perfect it! The exact control of centrifugal force vs. air currents, and the ease and permanency and accuracy of adjustment is the answer. This machine is simple. Slow in speed, with large feed openings—once adjusted and set you can depend upon it to select a product of any fineness, rejecting coarser sizes, automatically. For instance, selecting 30 tons of material, 90%—200 mesh, from 800 tons an hour of coarser material, is all in the day's work!

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★ Operate it in closed circuit with a pulverizer, and increase output 25 to 300%, save 10 to 50% power. Capacities ¼ to 50 tons an hour, with uniform separation of materials ranging from 50 to 350 mesh. Will handle Cement, Lime, Clay, Talc, Gypsum, Ceramics, Refractories, Phosphates, Chemicals, many products. *You'll find complete specifications in Bulletin 087. Simply write for it.*

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They keep books, making printed records of incoming and outgoing shipments. They "read" themselves and *print* the weight record on a ticket or tape. They control batching. They measure paint ingredients. They guard secret formulas. They count small parts. They save time and money by preventing human errors. They can be fitted into your production flow to eliminate duplication of effort and accelerate output. If we can't show you how—that's our loss—not yours. Fairbanks, Morse & Co., 600 S. Michigan Avenue, Chicago, Illinois.

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DIESEL ENGINES · WATER SYSTEMS · PUMPS · SCALES · MOTORS · STOKERS · GENERATORS · FARM EQUIPMENT · RAILROAD EQUIPMENT

Scales

BUY WAR BONDS

CURRENT PRICES

INDUSTRIAL CHEMICALS

	Current Price	Last Month	Last Year
Acetone, drums, lb	\$0.085–\$0.109	\$0.085–\$0.109	\$0.85–\$0.109
Acid, acetic, 28%, bbl., cwt	3.38 – 3.63	3.38 – 3.63	3.38 – 3.63
Glacial 99.5%, drums	9.15 – 9.40	9.15 – 9.40	9.15 – 9.40
U. S. P. X 1, 99.5%, dr	10.95 –11.20	10.95 –11.20	10.95 –11.20
Boric, bbl., ton	109.00–113.00	109.00–113.00	109.00–113.00
Citric, kegs, lb	.20 – .23	.20 – .23	.20 – .23
Formic, cbys, lb	.10½– .11	.10½– .11	.10½– .11
Gallic, tech., bbl., lb	1.10 – 1.15	1.10 – 1.15	1.10 – 1.15
Hydrofluoric 30% drums, lb	.08 – .08½	.08 – .08½	.08 – .08½
Lactic, 44%, tech., light, bbl., lb	.073– .075	.073– .075	.073– .075
Muriatic 18°, tanks, cwt	1.05 –......	1.05 –......	1.05 –......
Nitric, 36°, carboys, lb	.05 – .05½	.05 – .05½	.05 – .05½
Oleum, tanks, wks., ton	18.50 –20.00	18.50 –20.00	18.50 –20.00
Oxalic, crystals, bbl., lb	.11¼– .13	.11¼– .13	.11¼– .13
Phosphoric, tech., c'bys., lb	.07½– .08½	.07½– .08½	.07½– .08½
Sulphuric, 60°, tanks, ton	13.00 –......	13.00 –......	13.00 –......
Sulphuric, 66°, tanks, ton	16.50 –......	16.50 –......	16.50 –......
Tannic, tech., bbl., lb	.71 – .73	.71 – .73	.71 – .73
Tartaric, powd., bbl., lb	.70 –......	.70 –......	.70 –......
Tungstic, bbl., lb	nom	nom	nom ......
Alcohol, amyl	......–......	......–......	......–......
From Pentane, tanks, lb	.131–......	.131–......	.131–......
Alcohol, Butyl, tanks, lb	.10¾– .18¾	.10¾– .19	.158–......
Alcohol, Ethyl, 190 p'f., bbl., gal	11.94 –......	11.94 –......	8.19 – 8.25
Denatured, 190 proof	......–......	......–......	......–......
No. 1 special, dr., gal. wks	.62 –......	.62 –......	.60 –......
Alum, ammonia, lump, bbl., lb	.03¾– .04	.03¾– .04	.03¾– .04
Potash, lump, bbl., lb	.04¼– .04¾	.04¼– .04¾	.04 – .04¼
Aluminum sulphate, com. bags, cwt	1.15 – 1.40	1.15 – 1.40	1.15 – 1.40
Iron free, bg., cwt	2.35 – 2.50	2.35– 2.50	1.85 – 2.10
Aqua ammonia, 26°, drums, lb	.02½– .03	.02½– .03	.02½– .03
tanks, lb	.02 – .02¾	.02 – .02¾	.02 – .02¾
Ammonia, anhydrous, cyl., lb	.16 –......	.16 –......	.16 –......
tanks, lb	.04½–......	.04½–......	.04½–......
Ammonium carbonate, powd. tech., casks, lb	.09¼– .12	.09¼– .12	.09½– .12
Sulphate, wks., ton	29.20 –......	29.20 –......	29.00 –......
Amylacetate tech., from pentane, tanks, lb	.145–......	.145–......	.145–......
Antimony Oxide, bbl., lb	.15 –......	.15 –......	.15 –......
Arsenic, white, powd., bbl., lb	.04 – .04½	.04 – .04½	.04 – .04½
Red, powd., kegs, lb	nom	nom	nom ......
Barium carbonate, bbl., ton	60.00 –65.00	60.00 –65.00	60.00 –65.00
Chloride, bbl., ton	79.00 –81.00	79.00 –81.00	79.00 –81.00
Nitrate, casks, lb	.11 – .12	.11 – .12	.10¾– .11
Blanc fix, dry, bbl., lb	.03½– .04	.03½– .04	.03½– .04
Bleaching powder, f.o.b., wks., drums, cwt	2.25 – 2.35	2.25 – 2.35	2.25 – 2.35
Borax, gran., bags, ton	44.00 –......	44.00 –......	44.00 –......
Bromine, cs., lb	.30 – .32	.30 – .32	.30 – .32
Calcium acetate, bags	3.00 –......	3.00 –......	3.00 –......
Arsenate, dr., lb	.07 – .08	.07 – .08	.07 – .08
Carbide drums, lb	.04½– .05	.04½– .05	.04½– .05
Chloride, fused, dr., del., ton	18.00 –24.00	18.00 –24.00	18.00 –24.00
flake, bags., del., ton	18.50 –25.00	18.50 –25.00	18.50 –25.00
Phosphate, bbl., lb	.07½– .08	.07½– .08	.07½– .08
Carbon bisulphide, drums, lb	.05½–......	.05½	.05½–......
Tetrachloride drums, gal	.73 – .80	.73 – .80	.73 – .80
Chlorine, liquid, tanks, wks., 100 lb	2.00 –......	2.00 –......	2.00 –......
Cylinders	.05¼– .06	.05¼– .06	.05¼– .06
Cobalt oxide, cans, lb	1.84 – 1.87	1.84 – 1.87	1.84 – 1.87
Copperas, bgs., f.o.b., wks., ton	18.00 –19.00	18.00 –19.00	18.00 –19.00
Copper carbonate, bbl., lb	.19¾– .20	.19¾– .20	.18 – .20
Sulphate, bbl., cwt	5.00 – 5.50	5.00 – 5.50	5.15 – 5.40
Cream of tartar, bbl., lb	.57 –......	.57 –......	.57 –......
Diethylene glycol, dr., lb	.14 – .15½	.14 – .15½	.14 – .15½
Epsom salt, dom., tech., bbl., cwt	1.90 – 2.00	1.90 – 2.00	1.90 – 2.00
Ethyl acetate, drums, lb	.12½–......	.12½–......	.12 –......
Formaldehyde, 40%, bbl., lb	.05½– .06	.05½– .06½	.05½– .06
Furfural, tanks, lb	.09 –......	.09 –......	.09 –......
Fusel oil, drums, lb	.18 – .19	.18 – .19	.18 – .19
Glaubers salt, bags, cwt	1.05 – 1.10	1.05 – 1.10	1.05 – 1.10
Glycerine, c.p., drums, extra, lb	.18¼–......	.18¼–......	.18¼–......

The accompanying prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to October 12

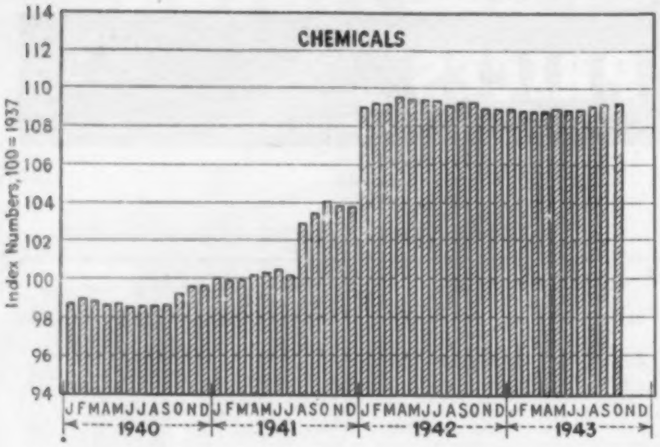
INDUSTRIAL CHEMICALS

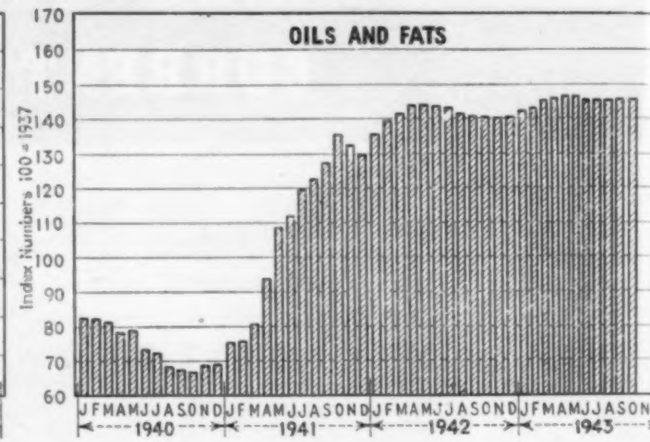
	Current Price	Last Month	Last Year
Lead:			
White, basic carbonate, dry casks, lb	.08¼–......	.08¼–......	.08¼–......
White, basic sulphate, sck., lb	.07¾–......	.07¾–......	.07¾–......
Red, dry, sck., lb	.09¼–	.09¼–......	.09¼–......
Lead acetate, white crys., bbl., lb	.12½– .13	.12½– .13	.12½– .13
Lead arsenate, powd., bag, lb	.11½– .12	.11½– .12	.11 – .12
Lime, chem., bulk, ton	8.50 –......	8.50 –......	8.50 –......
Litharge, powd., csk., lb	.08¼–......	.08¼–......	.08¼–......
Lithopone, bags, lb	.04¼– .04½	.04¼– .04½	.04¼– .04½
Magnesium carb., tech., bags, lb	.06¼– .06½	.06¼– .06½	.06¼– .06½
Methanol, 95%, tanks, gal	.58 –......	.58 –......	.60 –......
97%, tanks, gal	.58 –......	.58 –......	.60 –......
Synthetic, tanks, gal	.28 –......	.28 –......	.28 –......
Nickel salt, double, bbl., lb	.13¼– .13½	.13¼– .13½	.13¼– .13½
Orange mineral, csk., lb	.12½–......	.12½–......	.12½–......
Phosphorus, red, cases, lb	.40 – .42	.40 – .42	.40 – .42
Yellow, cases, lb	.18 – .25	.18 – .25	.18 – .25
Potassium bichromate, casks, lb	.09½– .10	.09½– .10	.09½– .10
Carbonate, 80–85%, calc. csk., lb	.06½– .07	.06½– .07	.06½– .07
Chlorate, powd., lb	.10 – .12	.10 – .12	.10 – .12
Hydroxide (c'stic potash) dr., lb	.07 – .07¼	.07 – .07¼	.07 – .07¼
Muriate, 60% bags, unit	.53½–......	.53½–......	.53½–......
Nitrate, bbl., lb	.05½– .06	.05½– .06	.05½– .06
Permanganate, drums, lb	.19½– .20	.19½– .20	.19½– .20
Prussiate, yellow, casks, lb	.17 – .18	.17 – .18	.17 – .18
Sal ammoniac, white, casks, lb	.0515– .06	.0515– .06	.0515– .06
Salsoda, bbl., cwt	1.00 – 1.05	1.00 – 1.05	1.00 – 1.05
Salt cake, bulk, ton	17.00 –......	17.00 –......	17.00 –......
Soda ash, light, 58%, bags, contract, cwt	1.05 –......	1.05 –......	1.05 –......
Dense, bags, cwt	1.10 –......	1.10 –......	1.10 –......
Soda, caustic, 76%, solid, drums, cwt	2.30 – 3.00	2.30 – 3.00	2.30 – 3.00
Acetate, del., bbl., lb	.05 – .06	.05 – .06	.05 – .06
Bicarbonate, bbl., cwt	1.70 – 2.00	1.70 – 2.00	1.70 – 2.00
Bichromate, casks, lb	.07¾– .08	.07¾– .08	.07¾– .08
Bisulphate, bulk, ton	16.00 –17.00	16.00 –17.00	16.00 –17.00
Bisulphite, bbl., lb	.03 – .04	.03 – .04	.03 – .04
Chlorate, kegs, lb	.06¼– .06½	.06¼– .06½	.06¼– .06½
Cyanide, cases, dom., lb	.14 – .15	.14 – .15	.14 – .15
Fluoride, bbl., lb	.08 – .09	.08 – .09	.08 – .09
Hyposulphite, bbl., cwt	2.40 – 2.50	2.40 – 2.50	2.40 – 2.50
Metasilicate, bbl., cwt	2.50 – 2.65	2.50 – 2.65	2.50 – 2.65
Nitrate, bulk, cwt	1.35 –......	1.35 –......	1.35 –......
Nitrite, casks, lb	.06¾– .07	.06¾– .07	.06¾– .07
Phosphate, tribasic, bags, lb	2.70 –......	2.70 –......	2.70 –......
Prussiate, yel. drums, lb	.10½– .11	.10½– .11	.10½– .11
Silicate (40° dr.), wks., cwt	.80 – .85	.80 – .85	.80 – .85
Sulphide, fused, 60-62%, dr. lb	.03 – .03½	.03 – .03½	.03 – .03½
Sulphite, crys., bbl., lb	.02½– .02¾	.02½– .02¾	.02½– .02¾
Sulphur, crude at mine, long ton	16.00 –......	16.00 –......	16.00 –......
Chloride, dr., lb	.03 – .04	.03 – .04	.03 – .04
Dioxide, cyl., lb	.07 – .08	.07 – .08	.07 – .08
Flour, bag, cwt	1.90 – 2.40	1.90 – 2.40	1.90 – 2.40
Tin Oxide, bbl., lb	.55 –......	.55 –......	.55 –......
Crystals, bbl., lb	.39½–......	.39½–......	.39½–......
Zinc, chloride, gran., bbl., lb	.05¾– .06	.05¾– .06	.05 – .06
Carbonate, bbl., lb	.14 – .15	.14 – .15	.14 – .15
Cyanide, dr., lb	.33 – .35	.33 – .35	.33 – .35
Dust, bbl., lb	.1035–......	.1035–......	.10¾–......
Oxide, lead free, bag, lb	.07¾–......	.07¾–......	.07¾–......
5% leaded, bags, lb	.07½–......	.07½–......	.07½–......
Sulphate, bbl., cwt	3.85 – 4.00	3.85 – 4.00	3.40 – 3.50

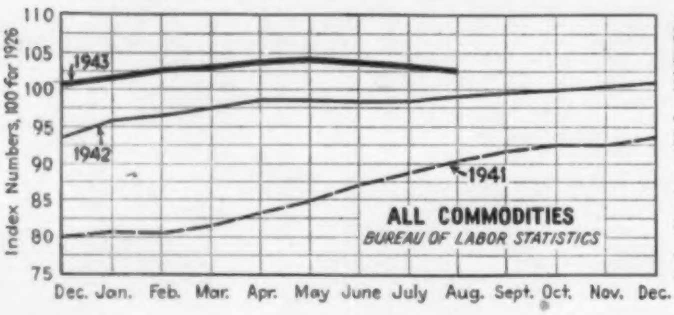
OILS AND FATS

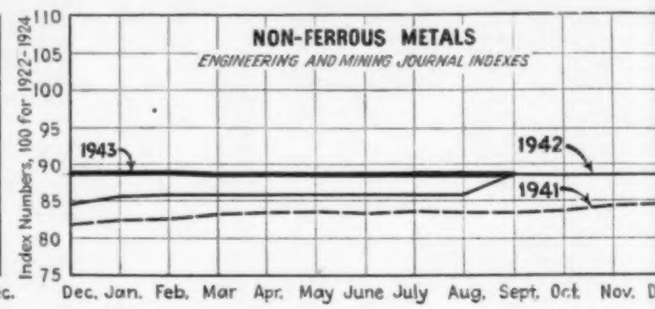
	Current Price	Last Month	Last Year
Castor oil, No. 3 bbl., lb	\$0.13¾–\$0.14½	\$0.13¾–\$0.14½	\$0.13¾–\$0.14½
Chinawood oil, bbl., lb	.38 –......	.38 –......	.38 –......
Coconut oil, Ceylon, tank, N. Y., lb	nom	nom	nom ......
Corn oil crude, tanks (f.o.b. mill), lb	.12¾–......	.12¾–......	.12¾–......
Cottonseed oil, crude (f.o.b. mill), tanks, lb	.12¾–......	.12¾–......	.12⅛–......
Linseed oil, raw car lots, bbl., lb	.153–......	.153–......	.133–......
Palm, casks, lb	.09 –......	.09 –......	.09 –......
Peanut oil, crude, tanks (mill), lb	.13 –......	.13 –......	.12¾–......
Rapeseed oil, refined, bbl., lb	nom	nom	nom ......
Soya bean, tank, lb	.11¾–......	.11¾–......	.11¾–......
Sulphur (olive foots), bbl., lb	nom	nom	.19⅛–......
Cod, Newfoundland, bbl., gal	nom	nom	nom ......
Menhaden, light pressed, dr., lb	.1305–......	.1305–......	.117–......
Crude, tanks (f.o.b. factory) lb	.089–......	.089–......	.64 –......
Grease, yellow, loose, lb	.08¼–......	.08¼–......	.08¼–......
Oleo stearine, lb	.09½–......	.09½–......	.09½–......
Oleo oil, No. 1	.11½–......	.11½–......	.11½–......
Red oil, distilled, dp.p. bbl., lb	.11¾–......	.11¾–......	.11¾–......
Tallow extra, loose, lb	.08⅝–......	.08⅝–......	.08⅝–......

Chem. & Met.'s Weighted Price Indexes









Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-napthol, crude bbl., lb	$0.52- $0.55	$0.52- $0.55	$0.52 -$0.55
Alpha-naphthylamine, bbl., lb	.32 - .34	.32 - .34	.32 - .34
Aniline oil, drums, extra, lb	.15 - .16	.15 - .16	.15 - .16
Aniline, salts, bbl., lb	.22 - .24	.22 - .24	.22 - .24
Benzaldehyde, U.S.P., dr., lb	.85 - .95	.85 - .95	.85 - .95
Benzidine base, bbl., lb	.70 - .75	.70 - .75	.70 - .75
Benzoic acid, U.S.P., kgs., lb	.54 - .56	.54 - .56	.54 - .56
Benzyl chloride, tech., dr., lb	.23 - .25	.23 - .25	.23 - .25
Benzol, 90%, tanks, works, gal	.15 -......	.15 -......	.14 -......
Beta-naphthol, tech., drums, lb	.23 - .24	.23 - .24	.23 - .24
Cresol, U.S.P., dr., lb	.11 -......	.11 - .11	.10¾- .11
Cresylic acid, dr., wks., gal	.81 - .83	.81 - .83	.81 - .83
Diethylaniline, dr., lb	.40 - .45	.40 - .45	.40 - .45
Dinitrophenol, bbl., lb	.23 - .25	.23 - .25	.23 - .25
Dinitrotoluol, bbl., lb	.18 - .19	.18 - .19	.18 - .19
Dip oil, 15%, dr., gal	.23 - .25	.23 - .25	.23 - .25
Diphenylamine, dr. f.o.b. wks., lb	.60 -......	.60 -......	.60 -......
H-acid, bbl., lb	.45 - .50	.45 - .50	.45 - .50
Naphthalene, flake, bbl., lb	.07 - .07½	.07 - .07½	.07 - .07½
Nitrobenzene, dr., lb	.08 - .09	.08 - .09	.08 - .09
Para-nitraniline, bbl., lb	.47 - .49	.47 - .49	.47 - .49
Phenol, U.S.P., drums, lb	.10½- .11	.10½- .11	.13 -......
Picric acid, bbl., lb	.35 - .40	.35 - .40	.35 - .40
Pyridine, dr., gal	1.70 - 1.80	1.70 - 1.80	1.70 - 1.80
Resorcinol, tech., kegs., lb	.75 - .80	.75 - .80	.75 - .80
Salicylic acid, tech., bbl., lb	.33 - .40	.33 - .40	.33 - .40
Solvent naphtha, w.w., tanks, gal	.27 -......	.27 -......	.27 -......
Tolidine, bbl., lb	.86 - .88	.86 - .88	.86 - .88
Toluol, drums, works, gal	.33 -......	.33 -......	.32 -......
Xylol, com., tanks, gal	.26 -......	.26 -......	.26 -......

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton	$22.00-$25.00	$22.00-$25.00	$22.00-$25.00
Casein, tech., bbl., lb	.21 - .23½	.21 - .23½	.18- .19
China clay, dom., f.o.b. mine, ton	8.00 -20.00	8.00 -20.00	8.00 -20.00
Dry colors			
Carbon gas, black (wks.), lb	.0335- .30	.0335- .30	.0335- .30
Prussian blue, bbl., lb	.36 - .37	.36 - .37	.36 - .37
Ultramarine blue, bbl., lb	.11 - .26	.11 - .26	.11 - .26
Chrome green, bbl., lb	.21½- .30	.21½- .30	.21½- .30
Carmine, red, tins, lb	4.60 - 4.75	4.60 - 4.75	4.60 - 4.75
Para toner, lb	.75 - .80	.75 - .80	.75 - .80
Vermilion, English, bbl., lb	3.05 - 3.10	3.05 - 3.10	3.05 - 3.10
Chrome yellow, C.P., bbl., lb	.14½- .15½	.14½- .15½	.14½- .15½
Feldspar, No. 1 .o.b.N.C.), ton	6.50 - 7.50	6.50 - 7.50	6.50 - 7.50
Graphite, Ceylon, lump, bbl., lb	.08 - .10	.08 - .10	.08 - .10
Gum copal Congo, bags, lb	.09 - .30	.09 - .30	.09 - .30
Manila, bags, lb	.09 - .15	.09 - .14	.09 .15
Demar, Batavia, cases, lb	.10 - .22	.10 - .20	.10 - .22
Kauri, cases, lb	.18 - .60	.17 - .60	.18 - .60
Kieselguhr (f.o.b. mines), ton	7.00 -40.00	7.00 -40.00	7.00 -40.00
Magnesite, calc, ton	64.00 -......	64.00 -......	64.00 -......
Pumice stone, lump, bbl., lb	.05 - .07	.05 - .08	.05 = .07
Imported, casks, lb	nom	nom	nom ......
Rosin, H., 100 lb	4.63 -......	4.57-......	4.01-......
Turpentine, gal	.76½-......	.75 -......	.64 -......
Shellac, orange, fine, bags, lb	.39 -......	.39 -......	.39 -......
Bleached, bonedry, bags, lb	.39 -......	.39 -......	.39 -......
T. N. bags, lb	.31 -......	.31 -......	.31 -......
Soapstone (f.o.b. Vt.), bags, ton	10.00 -12.00	10.00 -12.00	10.00 -12.00
Talc. 200 mesh (f.o.b. Vt.), ton	8.00 - 8.50	8.00 - 8.50	8.00 - 8.50
200 mesh (f.o.b. Ga.), ton	6.00 - 8.00	6.00 - 8.00	6.00 - 8.00

Industrial Notes

ROBINS CONVEYORS INC., Passaic, N. J., has added Francis O. Clukies to the sales staff of its New York office.

THE C. O. BARTLETT & SNOW CO., Cleveland, has appointed Martell & Ferree, 1505 Race St., Philadelphia, as sales representatives in Delaware, southern New Jersey, and eastern Pennsylvania.

CUTLER-HAMMER, INC., Milwaukee, has placed B. M. Horter in charge of purchasing activities to succeed F. S. Wilhoit retired.

K. H. HUPPERT CO., Chicago, has moved its general offices and equipment to its new building at 6830 South Cottage Grove Ave.

LUKENS STEEL CO., Coatesville, Pa., has elected J. Frederic Wiese vice-president. He will be in charge of sales of Lukens and its subsidiaries, By-Products Steel Corp., and Lukenweld, Inc. Robert H. McCracken has been appointed manager of combined sales at the Boston office.

THE FALK CORP., Milwaukee, has placed Charles A. Petri in charge of advertising to replace Ralph H. Deihl who has joined the armed forces.

PUMP ENGINEERING SERVICE CORP., Cleveland, has changed its name to Pesco Products Co. This does not affect personnel or the affiliation with Borg-Warner, the parent company.

THE EDWARD VALVE & MFG. CO., INC., East Chicago, Ind., has appointed the Dunbar Engineering Co., New York, sales representative for Connecticut and W. E. Bowler, Philadelphia, representative for the Reading, Pa., territory.

FARREL-BIRMINGHAM CO., INC., Ansonia, Conn., has announced the addition of G. V. Kullgren to the staff of its office in Akron, Ohio.

GENERAL ELECTRIC CO., Schenectady, N. Y., has moved the sales and order service headquarters of the resin and insulation materials division from Bridgeport, Conn. to Schenectady.

DETROIT REX PRODUCTS CO., Detroit, is now the Detrex Corp. This change involved no change in ownership, company policy, or management.

THE CLAUDE B. SCHNEIBLE CO., Chicago, has moved its engineering, sales, and production activities to 2827 Twenty-fifth St., Detroit. A sales office will be maintained at 4554 N. Broadway, Chicago.

THE LOUDON MACHINERY CO., Fairfield, Iowa, has opened a branch office at Atlanta, Ga., with C. S. Easley in charge.

HIS SKILL

IS AN ARMSTRONG PLUS VALUE

OLD timers in the insulation business will tell you that no insulating material is better than the way it's erected. This is one way of saying that it's wise to have an expert handle the construction end of your insulation work.

As an "old timer" in the field, no one knows this better than Armstrong. That's why all Armstrong district offices and distributors—located at strategic points throughout the nation—maintain complete crews of skilled mechanics who are specialists in erecting low-temperature insulation. This is the *plus value* you get in addition to the right material at Armstrong.

Three efficient types of low-temperature insulation —Armstrong's Corkboard, Foamglas, and Mineral Wool Board plus cork covering for cold lines—are offered by Armstrong. When you consult "Insulation Headquarters" you can be sure that Armstrong's engineers will specify the particular material best suited to your job.

When you're ready for your next insulating job, plan on bringing your problem to "Insulation Headquarters." In the meantime, why not get the facts about low-temperature insulating materials. Write today to Armstrong Cork Company, Building Materials Division, 3310 Concord Street, Lancaster, Pa.

ARMSTRONG CORK COMPANY

Insulation Headquarters

NEW CONSTRUCTION

	Current Projects		Cumulative 1943	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	....	$547,000	$335,000	$515,000
Middle Atlantic	....	2,710,000	14,519,000	13,876,000
South	$1,287,000	600,000	8,770,000	28,143,000
Middle West	1,005,000	5,240,000	10,195,000	15,600,000
West of Mississippi	1,610,000	380,000	15,540,000	15,975,000
Far West	....	....	15,525,000	57,603,000
Canada	195,000	86,000	11,281,000	1,871,000
Total	$4,097,000	$9,563,000	$76,165,000	$133,583,000

PROPOSED WORK

Colorado—Gates Rubber Co., 999 South Broadway, Denver, plans to expand its plant. Post War Project. Estimated cost $1,500,000.

Georgia—Goodyear-Decatur Mills, Rockmart, plan to expand their rayon cord mill. Estimated cost $1,247,000. Federally financed.

Illinois—Abbott Laboratories, Sheridan St., North Chicago, plan to construct an addition to their plant for the manufacture of penicillin. Federally financed. Estimated cost $235,000.

Indiana—Commercial Solvents Corp., 1331 South First St., Terre Haute, is having plans prepared by E. B. Badger & Sons Co., Archts. & Engrs., 75 Pitts St., Boston, Mass., for the construction of a plant for the manufacture of penicillin. Estimated cost $400,000. Federally financed.

Indiana—Eli Lilly Corp., 740 South Alabama St., Indianapolis, plans to construct a plant for the manufacture of penicillin. Estimated cost $370,000. Federally financed.

Tennessee—Firestone Tire & Rubber Co., c/o Davis, Firestone Blvd., Memphis, Tenn., plans to construct a plant.

Tex., Yantis—Warren Petroleum Co., Marshall, plans to construct four new units at its plant here. Estimated cost $110,000.

B. C., Victoria—International Pulpwood Supply Co., 13138 Standard Bank Bldg., Vancouver, plans to construct a chipping plant to supply material for pulp mills. Estimated cost between $100,000 and $125,000.

Ont., Toronto—Dominion Tar & Chemical Co., Ltd., 14 Morse St., plans to remodel its plant.

Que., Kilmar—Canadian Refractories, Ltd., Canada Cement Bldg., Montreal, plans to construct an addition to its plant.

CONTRACTS AWARDED

Alabama—Goodyear Tire & Rubber Co., 1144 East Market St., Akron, O., has awarded the contract for the construction of a rayon cord manufacturing plant to A. K. Adams Construction Co., 542 Plum St., N. W., Atlanta, Ga. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost $600,000.

Conn., Stamford—American Cyanamid Co., 1937 West Main St., has awarded the contract for factory expansion including 5 story, 76x98 ft. addition to Plant No. 12, 2 story, 62x175 ft. addition to Plant No. 13, 2 story, 64x300 ft. addition to Plant No. 23 and 1 story, 40x60 ft. addition to Plant No. 28, to Chemical Construction Co., 1937 West Main St., Stamford at $546,500.

Delaware—Nicaro Nickel Co., 205 East 42nd St., New York, N. Y., has awarded the contract for enlarging, rehabilitating plant for smelting nickel oxide to Turner Construction Co., 69th St. and Elmwood Ave., Philadelphia, Pa. Project will be financed by Defense Plant Corp. Estimated cost $700,000.

Iowa—Defense Plant Corp., 811 Vermont Ave., N. W., Washington, D. C., has awarded the contract for the construction of an alcohol plant to Weitz Construction Co., 406 Fleming Bldg., Des Moines, and Preister Construction Co., Davenport Bank Bldg., Davenport. Estimated cost $270,000.

Michigan—Goodyear Tire & Rubber Co., East Market St., Akron, O., has awarded the contract for the construction of a factory to G. A. Fuller Co., 111 West Washington St., Chicago, Ill. Project will be federally financed. Estimated cost $200,000.

New Jersey—Socony-Vacuum Oil Co., Paulsboro, has awarded the contract for the design and construction of an oil refinery to Lummus Co., 420 Lexington Ave., New York, N. Y. Project will be federally financed. Estimated cost $1,500,000.

N. Y., Brooklyn—Charles Pfizer & Co., 11 Bartlett St., has awarded the contract for the construction of alterations to its plant in connection with the manufacture of penicillin to W. J. Barney Corp., 101 Park Ave., New York, N. Y. Estimated cost including equipment $250,000.

O., Akron—Goodyear Tire & Rubber Co., 1144 East Market St., Akron, O., has awarded the contract for an addition to its plant for the manufacture of chemurgin to Indiana Engineering & Construction Co., 109 North Union Ave., Akron. Estimated cost $40,000.

O., Painesville—Industrial Rayon Corp., H. S. Rivitz, Pres., West 98th St. and Walford Ave., Cleveland, has awarded the contract for the construction of a plant for the manufacture of tire yarn to Austin Co., 16110 Euclid Ave., Cleveland. Estimated cost including equipment $5,000,000.

Pennsylvania—Defense Plant Corp., 811 Vermont Ave., N. W., Washington, D. C., has awarded the contract for the design and construction of a propane standby plant at alcohol plant, including 12 additional tanks and piping, to F. J. Richard & Co., Fidelity Bldg., Kansas City, Mo. Estimated cost $120,000.

Pa., Philadelphia—Bigler Chemical Co., Delaware Ave. and Packer St., has awarded the contract for the construction of a 2 story chemical plant to S. H. Levin, 1717 Sansom St., at $80,000.

Pa., Pittsburgh—Seaboard Glass & Bottle Co., R. R. Underwood, Pres., 26th St. and A. V. R. R. has awarded the contract for the construction of a 1 story, 60x300 ft. warehouse to Edwin G. Smith, 495 Lincoln Ave., Bellevue. Estimated cost $60,000.

Tex., College Station—A & M College of Texas, College Station, has awarded the contract for the construction of a cotton oil mill building to Ed. Johnson, P. O. Box 424, Waco. Estimated cost $40,000.

Tex., Houston—Phoenix Refinery, Inc., 720 Manchester St., will improve and reconstruct its refinery, including cooling towers, pump house, etc. Work will be done by force account. Estimated cost $70,000.

Ont., Elmira—Naugatuck Chemicals, Ltd., Elmira, has awarded the contract for the construction of a 1 story, 38x146 ft. pilot building to Dunker Construction Co., Ltd., 251 King St. W., Kitchener. Estimated cost $45,000.

Ont., Toronto—Bakelite Corp. of Canada, Ltd., 163 Dufferin St., has awarded the contract for a 2 story, 40x60 ft. addition to its plant to Miln & Nicholls, Ltd., 57 Bloor St., W., at $41,000.